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OCS Study
MMS 90-0089

California, Oregon, and Washington Archaeological Resource Study

Volume III: Prehistory

Project Editors

Robert L. Gearhart II
Clell L. Bond
Steven D. Hoyt

Volume III Authors

Pandora Snethkamp, Ph.D.
Gary Wessen
Andrew L. York
James H. Cleland, Ph.D.
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Robert L. Gearhart II

Prepared under MMS Contract
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by
Espey, Huston & Associates, Inc.
P.O. Box 519
Austin, Texas 78767

Subcontractor:
Dames & Moore
San Diego, California

Published by

U.S. Department of the Interior
Minerals Management Service
Pacific OCS Region

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ABSTRACT

In May 1989, the Pacific OCS Region of MMS contracted with Espey, Huston & Associates, Inc. (EH&A) of Austin, Texas to conduct a study of the OCS between Morro Bay, California and the Canadian Border. Overviews are presented for late Pleistocene/Holocene geology of the OCS, for prehistory of the coastal zone, and for maritime history of the study area. Models are formulated to predict the areas in which prehistoric and historic archaeological sites are likely to be preserved on the OCS. Variables considered by these models include late Pleistocene and Holocene geology of the OCS, known archaeological site distributions, prehistoric settlement patterns, vessel traffic patterns, and the distribution of significant hazardous weather conditions. Holocene geology, known site distributions, and archaeological site predictive zones resulting from this project have been mapped at a scale of 1:250,000 and are bound as an atlas for inhouse use by MMS. Smaller scale copies of these maps, lacking specific locational information for archaeological sites, have been produced for public distribution. The results of this study will be used in evaluating exploration, development and transportation plans for mineral development activities on the OCS and in determining remote-sensing survey requirements that will apply to specific areas of the OCS.

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APPENDIX E - MMS SHIPWRECK DATABASE REFERENCE LIST
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Cover: Haida winter village (from America's fascinating Indian heritage, J.A. Maxwell, editor (1978))

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This report was critically reviewed by a Quality Review Board consisting of experts in geology, Pacific coast prehistory and marine archaeology. Our thanks to Dr. Curt Peterson (marine geologist and Assistant Professor with Portland State University), Dr. Lee Lyman (Northwest Coast prehistorian and faculty with the University of Missouri, Columbia), and Mr. J. Barto Arnold III (marine archaeologist with the State of Texas) for serving on the review board.

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1.0 INTRODUCTION

The goals of this examination of the prehistory of the study area are threefold: 1) to compile a synthesis of the prehistoric archaeology; 2) to construct a comprehensive map of known prehistoric site locations both offshore and onshore; and 3) to delineate predictive zones of prehistoric site locations.

1.1 Synthesis of Prehistoric Archaeology

Both published and unpublished literature and archaeological data pertaining to coastal zone and riverine area prehistory were examined. A synthesis of this information has been compiled for each planning area, arranged by cultural period. The synthesis includes discussions of site morphology and content, index artifacts and characteristic artifact assemblages. Models of settlement pattern and ecological adaptation are considered for development of predictive zones. Early prehistoric cultures are considered in relation to defining the temporal range of the period under study.

Geographically, the extent of the onshore portion of the study varies, being limited to within 0.5 kilometer (km) inshore from high rocky cliffs bordering narrow beaches and widened as necessary to include broad beaches with adjoining sand dunes, salt marshes, lagoons or estuaries. The study area within the San Francisco Bay system extends north and east to encompass northern San Pablo Bay, stopping on the east side at the Vallejo-Crockett Bridge. All of San Francisco Bay proper is included (Figure III-1).

1.2 Known Prehistoric Site Locations

Based on a review of the literature and data, a compilation of known archaeological sites, both onshore and offshore, was constructed. These sites were added to the dBase III Plus archaeological database provided by the MMS Pacific Region. The positions of these archaeological sites were then plotted on 1:250,000 scale contour maps to indicate their distribution within the study area. A discussion of the source materials and any data bias is included.

1.3 Prehistoric Site Predictive Zones

In conjunction with the archaeological literature and data, geological data for the study area has been synthesized. Based on these combined data, a predictive model for the locations of prehistoric sites has been constructed and a set of maps has been generated delineating the predictive zones of relative frequency for the location of sites within the coastal zone and offshore to a depth of 125 meters (m). Data used to define the predictive zones included settlement patterns, subsistence strategies and paleogeography (bottom topography, fluvial channels, marine terraces, and former islands from 1,000 years Before Present (B.P.) to 20,000 B.P.).

1.4 Study Organization

For the synthesis of cultural history and ethnography, the overall study area has been divided into six geographical subareas: central California, San Francisco Bay, northern California, Oregon, the Columbia River mouth, and Washington. A discussion of the settlement and subsistence systems is also provided within each subarea. Subsequent to the presentation of this data for the entire study area, the predictive model for the distribution of prehistoric sites is formulated.

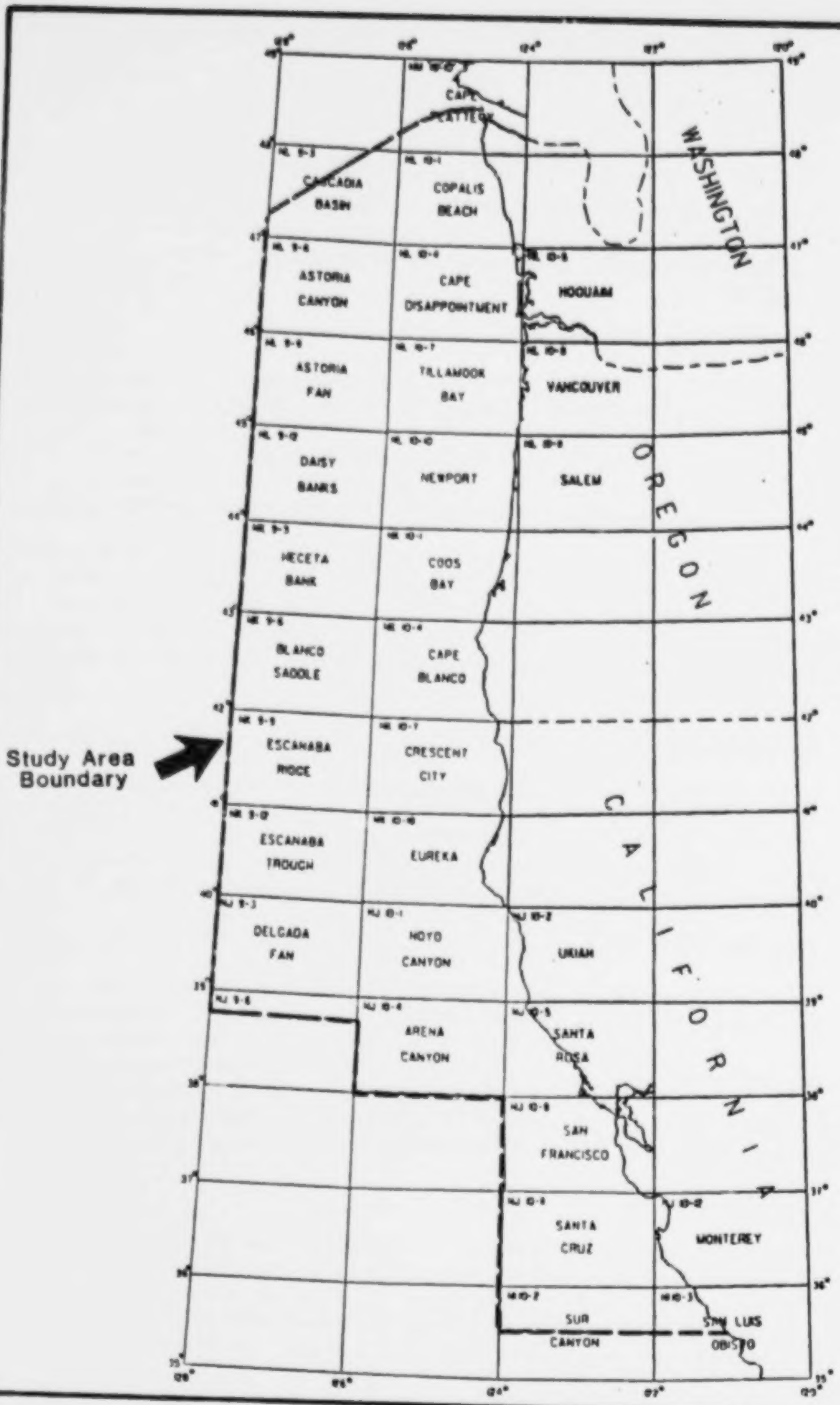

Study Area Boundary
WASHINGTON
OREGON
CALIFORNIA
CAPE FLATTERY
CASCADIA BASIN
COPALIS BEACH
ASTORIA CANYON
CAPE DISAPPOINTMENT
HOQUIAM
ASTORIA FAN
TILLAMOOK BAY
VANCOUVER
DAISY BANKS
NEWPORT
SALEM
HECETA BANK
COOS BAY
BLANCO SADDLE
CAPE BLANCO
ESCANABA RIDGE
CRESCENT CITY
ESCANABA TROUGH
EUREKA
DELGADA FAN
NOYO CANYON
UKIAH
ARENA CANYON
SANTA ROSA
SAN FRANCISCO
SANTA CRUZ
MONTEREY
SUR CANYON
SAN LUIS OBISPO

Figure III-1 Study Area for the California, Oregon and Washington Archaeological Study.

2.0 CULTURE HISTORY AND ETHNOGRAPHY

This section examines current knowledge of the prehistory and ethnography of the project area. Particular attention is given to the development of land use and subsistence systems, as these tend to most affect the distribution of archaeological materials. As one reviews the literature, however, it is quickly apparent that the project area has received uneven coverage by previous research, with some areas much better known than others: the Monterey and San Francisco Bay areas, for example, are relatively well represented by excavation data, while Northern California and the coastal Santa Lucias have seen little research.

It is also quickly apparent that as one moves back in time, the amount and reliability of data diminishes rapidly, so that the early Holocene is represented by only a handful of sites. Unfortunately, this period is particularly important for our purposes since sites dating to this period may best represent settlement and land use systems employed by populations that occupied areas that now lie offshore. Certainly, settlement patterns followed during the early Holocene must have differed from those followed during the ethnographic period, and these differences should be carefully considered in applying observed late patterns to the sensitivity of offshore (late Pleistocene-early Holocene) occupation areas. Nevertheless, certain principles can be applied to land use patterning throughout the prehistoric period. The following discussion develops these themes and provides the basis for the sensitivity assessment.

2.1 Central California

2.1.1 Previous Research

Initial archaeological research in coastal Central California began in the 1940s and early 1950s with the activities of the University of California at Berkeley. Extensive survey work was conducted in Monterey County by A.R. Pilling, who recorded over 350 sites in the Monterey and Big Sur areas (Pilling 1948); other studies include those by Greengo (1951), who sampled molluscan species in Monterey Bay sites, test excavations by Broadbent (1951), and various UCB field classes (see Moratto 1984:238). Excavations at Isabella Meadows Cave (Mnt-250) (Meighan 1955), a few miles inland from Point Sur, yielded cordage, basketry, beads, a cache of skins, and a child burial in 2.6 m of midden deposit (Figure III-2). Six bedrock mortars were also present, along with numerous pictographs. It was concluded that the materials represented a post-A.D. 500 Esselen occupation, with some use of the cave by Indians during the Mission Period.

Mnt-281/282 (Figure III-2), consisting of two vertically separated midden sites near the mouth of Willow Creek along the Big Sur coast, was excavated by Heizer in 1951 and Beardsley in 1952 (Pohorecky 1964, 1976). Artifacts and radiocarbon dates from the site indicate an occupation from roughly A.D. 50-100 to nearly historic times; major findings include (1) several important differences in the assemblages between Mnt-281 and -282, (2) exploitation of both littoral and terrestrial resources, and (3) apparent influences from both the north and the south (Moratto 1984:241).

Excavations at Mnt-101 (El Castillo), on the current site of the Monterey Presidio, were conducted in 1968 by W.E. Pritchard. Two test trenches revealed 280 centimeters (cm) of deposit containing a rich assemblage of groundstone, flaked stone, bone, and shell artifacts, as well as abundant faunal remains. Shell ornaments found in the lower levels indicated to Pritchard an initial occupation of roughly 2,000 to 3,000 years B.P., and projectile points were similar to those found at Willow Creek that were dated to 1,878±400 B.P. Possible evidence of subsistence change, with implications for later models of culture change (see discussions of the Sur and Monterey patterns below), is seen in Pritchard's observation that millingstones are much more abundant below 140 cm, while heavy concentrations of shell are found above that level (Pritchard 1968:69).

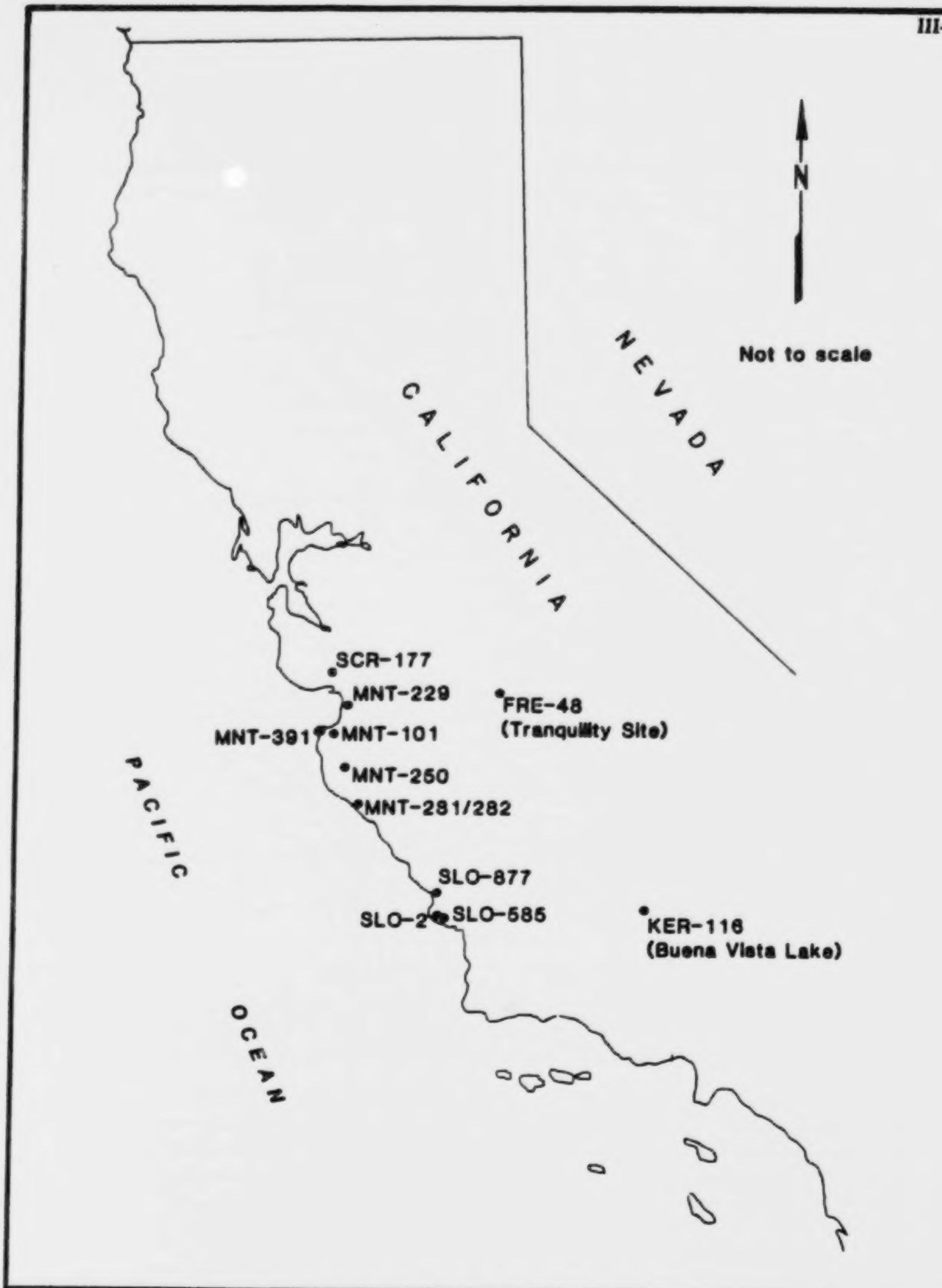

N
Not to scale
NEVADA
CALIFORNIA
SCR-177
MNT-229
FRE-48
(Tranquility Site)
MNT-391
MNT-101
MNT-250
MNT-281/282
PACIFIC
SLO-877
SLO-2
SLO-585
KER-116
(Buena Vista Lake)
OCEAN

Figure III-2. Key Sites Mentioned in Text for Central California.

Moratto (1984:242) considers the shift in economic focus evident at Mnt-101 to possibly represent replacement by Costanoan groups of older Esselen populations.

Archaeological research increased dramatically along the central coast during the 1970s, largely in response to the requirements of several pieces of environmental legislation. Most of this research suffers from the lack of interpretation typical of cultural resource management related work; significant exceptions are discussed below. Also active during the 1970s was Cabrillo College, which conducted a number of field classes, and the Monterey County Archaeological Society (MCAS), which excavated numerous sites under the direction of Don Howard (Howard 1971, 1972a, 1972b, 1973, 1976). MCAS's enthusiasm for digging, however, was not matched by attention to thorough reporting, and much of the data recovered at their excavations of more than 40 sites are either unavailable or resist interpretation.

Recently, models of prehistoric land use change along the central coast have been proposed that have direct implications for the present project. Breschini and Haversat (Breschini 1980, 1983; Breschini and Haversat 1978, 1980) have suggested that the Monterey region was originally inhabited by speakers of Hokan languages who followed a "foraging" strategy as defined by Binford (1980), and who are represented archaeologically by the "Sur Pattern"; these people were replaced by Penutian speakers who followed a "collecting" strategy, and who are represented archaeologically by the "Monterey Pattern".

Issues raised by Breschini and Haversat's model were addressed through excavations at 19 sites along the Monterey Peninsula by Archaeological Consulting and Research Services (Dietz and Jackson 1981). Dietz and Jackson believe their data suggest that around A.D. 0 and earlier, foraging people (probably Hokan speakers) were replaced by people using a collecting strategy, probably Penutian speakers. They refrain, however, from assigning these assemblages to "patterns," preferring to concentrate on the formulation of test implications for the model.

Also relevant to studies of settlement and subsistence change along the central coast are the extensive excavations recently conducted at Mnt-229 (Figure III-2), on the south side of Elkhorn Slough, near the center of Monterey Bay. These excavations involved both testing (Dondero et al. 1984) and data recovery (Dietz et al. 1988) at the site, preparatory to widening State Highway 1 at that point. A combined total of 127.5 cubic meters (m^3) of soil was excavated during the two projects. It was concluded by Dietz et al. (1988) that the site was occupied between ca. 2,600 B.C. and ca. A.D. 1840, with the most intensive occupation between 700 B.C. and A.D. 1100. The site appears to be a single-component deposit exhibiting characteristics of a seasonal residential base, and shows stronger cultural affiliation with areas to the south, rather than to sites in the San Francisco Bay area. These conclusions lend little support to the hypothesized subsistence shifts and changes in archaeological assemblages that would have attended the replacement of Hokan speakers by Penutian speakers during the time the site was occupied.

Finally, mention should be made of archaeological survey of several square miles along the Big Sur coast near Big Creek, conducted by T. Jones as part of the UC Santa Cruz Environmental Field Program (Jones et al. 1989). Numerous historic and prehistoric sites were recorded during three seasons of field work, and several prehistoric sites were tested. Results of this work indicate an increase in diversity of site location beginning about A.D. 0; however, since many previously occupied sites continued to be occupied during this time, this is seen as an adaptive shift rather than population replacement.

2.1.2 Culture History

2.1.2.1 Early Holocene

Environmental changes associated with the late Pleistocene-early Holocene transition (ca. 12,000 to 8,000 B.P.) featured climatic warming, rapidly rising sea levels, extensive vegetation changes, dessiccation of pluvial lakes, and faunal extinctions, and these changes would have profoundly affected any prehistoric populations occupying the study area. Since these people would have occupied sites inundated by rising sea levels associated with the Holocene, current knowledge of their adaptation is worth examining.

Throughout most of California, these sites are identified by the presence of fluted projectile points and chipped stone crescents, which may occur with a variety of other flaked lithic implements. Fluted points are elsewhere associated with a big-game hunting focus, but the California assemblages suggest a more generalized hunting and gathering economy (Moratto 1984:88). The specialized lakeshore adaptation, defined as the Western Pluvial Lakes Tradition (WPLT) (Bedwell 1970) may have evolved from an earlier, big-game hunting economy as highly productive shallow lake/grassland environments developed during the early Holocene; however, the origins of this tradition are at this point speculative (Moratto 1984:103).

Evidence of Paleo-Indian occupation of this portion of the project area is lacking, although evidence of late Pleistocene/early Holocene use of nearby areas has been found. The discovery of a fluted point along the coast of the Santa Barbara Channel (Erlandson et al. 1987), for example, may indicate use of areas near the central coast as early as 11,000 B.P. Of more importance is the discovery of an early Holocene site (SCr-177) near Scotts Valley, in the Santa Cruz Mountains (Figure III-2). Initial investigations at this site yielded radiocarbon dates of 7,180±290 and 10,080±460 B.P. from test units, along with chert points, obsidian flakes, groundstone, fire-affected rock, and charcoal. Nearby site SCr-244 contained a similar collection (Cartier 1982:229).

Subsequent large-scale excavations at SCr-177 conducted in 1983 and again in 1987 yielded radiocarbon dates spanning nearly the entire Holocene, including several in the 10,000- and 12,000-B.P. range from the basal strata. Obsidian hydration studies also indicate considerable antiquity for the site, exhibiting the widest rims known for Napa obsidian in sites in the San Francisco and Monterey Bay areas (Cartier 1989:97). Artifacts recovered include a variety of chipped stone forms similar to those found at other early sites in central and southern Californa, inluding Tulare Lake (Riddell and Olson 1969), Buena Vista Lake (Frederickson and Grossman 1977) Rancho Park North near San Diego (Kaldenberg and Ezell 1974), and Borax Lake (Meighan and Haynes 1970). These artifacts inlude large chert bifaces, basalt scrapers, and one eccentric chipped stone crescent. The site may be associated with a Pleistocene-age lake or marsh area, but this is as yet unsubstantiated.

2.1.2.2 Early Coastal

A coastal adaptation contemporaneous with the WPLT is proposed by some researchers. This tradition, termed the Paleo-Coastal Tradition (PCT) (Davis 1969; Moratto 1984), appears to have focused on lagoons and marshes, much as the WPLT peoples focused on lake and marsh shores further inland. Again, examples are rare, and it is uncertain whether such materials represent a separate tradition or simply a coastal expression of the WPLT.

The issue is complicated by the rapid sea level rises associated with the early Holocene, which would have either eroded or inundated sites along the coast, depending on local conditions. At 10,000 B.P., the coastline may have been as much as 10 km to the west of its present location (Moratto 1984:108), and estimates of coastal erosion during the Holocene amount to as much as 15 to 25 cm per year. This suggests (1) that most early Holocene coastal sites have either been destroyed by erosion or inundated by rising sea levels, and (2) that remaining early sites were established in settings unaffected by rising sea levels, e.g. some distance from the coast or in steep areas above the water.

Evidence of early Holocene occupation of the central coast has been summarized by Breschini and Haversat (1988). To date, few sites in San Luis Obispo, Monterey, and Santa Cruz counties contain evidence of early Holocene occupation, and of these, fewer appear to have been situated in coastal settings. One additional site (Mnt-229, discussed below) has yielded several early dates, but all were attributed to the "reservoir effect" and considered erroneous; however, some lines of evidence point to the validity of at least some of these dates. At SLO-801, dates of 7,210±220, 7,565±125, and 8,540±140 were obtained from samples recovered by R. Gibson during construction monitoring. Unfortunately, no further investigations were conducted (Breschini and Haversat 1988:7).

An expression of the PCT may have been identified at two sites (SLO-2 and -585) at Diablo Canyon (Figure III-2), on San Luis Obispo Bay just south of the study area (Greenwood 1972). Excavation of SLO-585 yielded dates of abalone shell of 8,410±190 years, at levels above a number of millingstones and manos, thus making the lowest stratum of this site roughly contemporary with the oldest known millingstones in San Diego County (Moratto 1984:107).

SLO-2 is a deep midden site that contained Millingstone, Hunting Period, and Chumash assemblages, as well as evidence of occupation as early as ca. 9,320 B.P. This date was obtained from bone in a human burial that was associated with flakes, a core, a pitted stone, and a hammerstone, but no milling tools. Greenwood's analysis of materials from the lower component of SLO-2 revealed a number of similarities with both assemblages from the Borax Lake site in northern California (wide-stemmed projectile points, large blades, flat-bottomed scrapers and milling equipment) and Millingstone assemblages from southern California, including large stemmed and side-notched projectile points and milling tools (Greenwood 1972:89). To account for these similarities, Greenwood suggests that both the Borax Lake and Millingstone assemblages derive from inland lacustrine oriented groups, who moved toward the coast in response to environmental changes. These people would have diverged in adaptation, continuing with a riverine or lacustrine economy in the north and developing a seed-oriented economy in the south (Greenwood 1972:93).

Particularly significant about the Diablo Canyon assemblages is the diversity of faunal remains in the early component, and the continuation of use of these resources throughout the site's occupation. Faunal remains from the lower component include California mussel and other shellfish, sea lion, harbor seal, elephant seal, sea otter, bear, badger, mountain lion, deer, rabbit, pelican, cormorant, snow goose, and 13 species of fish, all of which continue to be found throughout the deposit.

Along the central coast within the project area, sites potentially dating to an early coastal (pre-ca. 5500 B.P.) occupation are present only at SLO-877 near Cayucos (Breschini and Haversat 1988) and at Mnt-229 on Elkhorn Slough (Dietz et al. 1988). Both of these sites were close to the shoreline at this time. Mnt-229 yielded seven radiocarbon dates between 6,000 and 7,700 B.P.; of these, five were obtained from *Protothaca* shell, one from *Tresus*, and one from a fragment of elk bone. Dietz et al. (1988) reject these early dates, noting that in several instances at the site, *Protothaca* samples yielded substantially older dates than charcoal from the same feature. They offer the "reservoir effect" as a possible explanation, whereby ancient carbons, possibly from upwelling in the Monterey Submarine Canyon, may have accumulated in slough-dwelling species (Dietz et al. 1988:124). The same explanation is offered for the early date for the elk bone, though it is unclear how a large migratory mammal would accumulate ancient carbons from the slough in the same manner as a slough-dwelling shellfish. It should also be pointed out that the mechanisms of reservoiring ancient carbon in Elkhorn Slough are not as yet well understood, and it remains unclear whether such a process significantly affects shell dates in the area.

For these reasons, some controversy remains over the possible presence of an early coastal presence at Mnt-229. For the moment, it seems best to view the early dates as possibly indicating an early occupation, albeit one that was relatively much less intense than later use of the site, given the absence of a demonstrably early assemblage.

At SLO-877, a small early Holocene component, radiocarbon dated to 6,865±120 and 8,080±100 B.P., was identified underneath a mid-Holocene occupation. It was found that *Mytilus* was the dominant species in the early component, while *Tivela* was more abundant in the later component. This apparent change in shellfish exploitation may be due to changes in the coastal environment or may reflect increasing distance to the coast. Both terrestrial and marine resources are represented in the early component (Breschini and Haversat 1988:8).

2.1.2.3 Sur Pattern

Subsequent periods along the central coast are better documented, and several recent studies have focused on changing adaptive strategies among prehistoric populations. Recently, Breschini and Haversat (1980) have proposed a model purporting to identify and explain a major adaptive shift occurring in the Monterey Bay area about 2,000 years ago. This model derives in large part from mobility theory (Binford 1980), and proposes two consecutive archaeological "patterns", each with a characteristic land use strategy and probable ethnic affiliations. The earlier pattern, designated the "Sur Pattern", is thought to have been present by 5,500 B.P. or earlier and is characterized by an economic pattern typical of "foragers" as defined by Binford. Breschini and Haversat believe the economic pattern of Sur Pattern peoples to have been generalized, with relatively little specialization, and expect site contents to reflect a wide variety of activities. Sur Pattern peoples are thought to represent "ancestors of the Esselen" (Breschini and Haversat 1980:14-15). In contrast to the later (Monterey Pattern) "shell midden" sites, Sur Pattern sites are characterized as "middens with shell", reflecting the generalized economy (Breschini 1983:88).

The Breschini and Haversat model has been criticized on several fronts (Dietz et al. 1988; Jones and Hylkema 1988), primarily on the grounds that the proposed "patterns" are as yet unsupported by archaeological assemblages, and that archaeological components are assigned based solely on radiocarbon dates. Nevertheless, recent research suggests that a foraging strategy was practiced during earlier periods, to be replaced by a collecting strategy. The apparent timing of this replacement appears to be considerably later than proposed by Breschini and Haversat, however, and the reasons for the shift remain unclear; but it appears that cultural changes in the central coast can be profitably discussed within the forager/collector framework.

The Dietz and Jackson (1981) report on excavation of 19 Monterey Peninsula sites (see above) provided a revision and clarification of the Breschini and Haversat model, presenting clear test implications regarding economic changes in the Monterey area. Dietz and Jackson considered their results to indicate that the earlier inhabitants of the Monterey Peninsula practiced a foraging strategy that featured "seasonal residential moves among a series of resource patches, gathering of foods daily on an 'encounter' basis with return to a residential base near the end of each day, no use of storage, a limited foraging radius around residential bases, considerable variability in the size of foraging groups and the number of residential moves made in a year, considerable variability in the redundancy of land use from year to year, and the possible occasional occurrence of extended resource procurement trips from residential bases (Dietz and Jackson 1981:700)." Four sites identified by Dietz and Jackson were considered to represent a forager strategy, which they felt was probably practiced by Hokan (possibly ancestral Esselen) speakers.

While Moratto (1984:250-251) considers these sites to be "identifiable" with the Sur Pattern, Dietz and Jackson make no such connection, regarding the "patterns" to be as yet poorly defined. Nevertheless, implications for intersite patterning during earlier periods are clear: forager residential bases were expected by Dietz and Jackson to be adjacent to protected bays along the coastline, associated with fresh water, and near marine and terrestrial resources (Dietz et al. 1988:15).

2.1.2.4 Monterey Pattern

The Monterey Pattern is proposed by Breschini and Haversat (1980) to represent the movements of Costanoan speakers into the central coast, bringing with them a "collecting" strategy (Binford 1980) and replacing the earlier Hokan-speaking foragers. Believed to have become established in the Monterey area around 2,500 B.P., the Monterey Pattern features sites with extremely dense accumulations of shell ("shell middens", as opposed to Sur Pattern "middens with shell"), including the extensive concentrations of abalone shell observed in many sites in Monterey Bay. Breschini (1983:84) considers many of these sites to represent campsites used for collecting and processing marine resources, or collecting/processing stations visited from permanent villages further inland.

Dietz and Jackson (1981) elaborated on the strategies thought to have been used by the more recent inhabitants of the region, though again they refrain from assigning these to the "Monterey Pattern". The "collectors" identified by Dietz and Jackson were characterized by "...the storage of food during part of the year, logistically organized resource procurement parties (labor groups), and the use of residential bases (permanent and seasonal), camps, locations, stations, and caches (Binford 1980)." The results of their investigations indicate considerable complexity, with some sites exhibiting characteristics of field camps, locations, stations, and caches.

Certain changes in economic patterns, however, were evident. Frequencies of shell were found to increase with time, but the frequency of mussel relative to abalone was found to decline; this was thought to possibly result from overexploitation of mussel during later periods. Terrestrial mammals, including deer and rabbit, were increasingly exploited, while use of sea mammals and birds declined. Finally, tool diversity was higher in the later sites (Dietz et al. 1988:16).

Subsequent investigations in Monterey, however, have further complicated the issue. Excavations at Mnt-229, a large midden site on the south side of Elkhorn Slough (Dietz et al. 1988), indicated that the site was used as a residential base for foraging populations during its entire period of use between ca. 2,700-900 B.P. Moreover, cultural traits observed at the site have stronger affinities with the south than with the bay area, arguing against intrusion by groups from the north. These results suggest that the hypothesized Costanoan intrusion did not occur at the time proposed by Breschini and Haversat, and that an across-the-board shift in subsistence strategy (the Sur to Monterey Pattern) is not evident at that time. Dietz et al. suggest instead that the hypothesized intrusion took place considerably later (after 900 B.P.), or that observed cultural changes took place *in situ* (Dietz et al. 1988:424).

Going a bit further are Jones and Hylkema (1988), who "seriously question" the entire Sur/Monterey Pattern concept, pointing out that (1) no assemblages have been defined upon which to base "pattern" definitions; (2) proposing the Sur/Monterey "patterns" as time periods and then assigning archaeological components to them based solely on radiocarbon dates (see Moratto 1984:248-249) is a tautology; (3) there has never been any quantification of the varying shellfish densities supposed to characterize the patterns; and (4) the use of shellfish density in this regard is questionable, given the many noncultural factors that influence shell density (Jones and Hylkema 1988:183).

2.1.3 Ethnography

2.1.3.1 Chumash

Language: The six languages in the Chumashan family (Figure III-3) have been placed within the Hokan linguistic stock.

Territory: Chumashan groups, who controlled the entire Santa Barbara Channel area including the Channel Islands, are represented in the project area by the Obispeno, who controlled coastal areas in the vicinity of present San Luis Obispo, including the Morro Bay area. The northern coastal boundary of the Obispeno is not well defined, with Kroeber (1925) and Greenwood (1978) placing it near present Cayucos in Estero Bay, but with more recent work based on mission records placing it as far north as the San Carpoforo drainage near Piedras Blancas (Gibson 1977; Hampson et al. 1982).

Subsistence: The Chumash practiced a hunting and gathering economy heavily supplemented by marine products. The bulk of the diet was provided by vegetal resources, including acorns, hard seeds, roots, berries, pine nuts, and bulbs, while terrestrial mammals, including deer, rabbit, and rodents were also eaten. Sea mammals were hunted, including sea lion, sea otter, and seal, and a great variety of shellfish and other marine invertebrates were collected. Steelhead and salmon were caught, as well as a variety of species of marine fish.

Marine resources apparently were somewhat less important to the Chumash groups north of Point Conception than to those inhabiting the Santa Barbara Channel to the south. This may be due to the relatively more turbulent coastline which may have restricted exploitation of species available by watercraft (plank canoes, dugouts, and tule floats) in the calmer channel waters. These differences are reflected in artifact assemblages, with a more restricted fishing-related technology and relatively fewer remains of sea mammals found in Obispeno territory. Shellfish remains, however, are much more abundant in late period coastal middens north of Point Conception than in those on the Channel (Glassow and Wilcoxon 1988).

Settlement: Environmental differences between the relatively calm coast of the Santa Barbara Channel and the rougher coastline north of Point Conception resulted in somewhat divergent settlement patterns between the Barbareno and the groups to the north. Early explorers of the coast of the channel describe 21 villages along the coast between the Ventura River and Point Conception, of which 17 were inhabited. Villages along the channel were usually placed either on the edge of a slough area or on high ground on the side of a stream where it emptied into the ocean. They typically contained several hemispherical thatched houses, storehouses, a sweathouse, a ceremonial enclosure, a gaming area, and a cemetery (Grant 1978:510).

Among the Purisimo and Obispeno, villages were smaller, without the regular arrangements of houses that were noted along the channel. Houses were smaller than those to the south, and some villagers apparently lived in the open. Villages were often split, with occupations on both sides of streams or other features; this possibly reflects internal differentiation such as a moiety system (Greenwood 1978:521).

2.1.3.2 Salinan

Language: The Salinan language, also of the Hokan stock, is divided into the Migueleno and Antoniano dialects, with a third "playano" dialect proposed by some researchers (Kroeber 1925:546).

Territory: Salinan territory (Figure III-3) covered an area of roughly 3,000 square miles in the southern Santa Lucia range and Salinas Valley. Precise territorial boundaries are unclear, but their territory is generally taken to extend from the vicinity of Piedras Blancas on the south (see above) eastward to the San Joaquin Valley (Gibson 1983:24) and northward to present

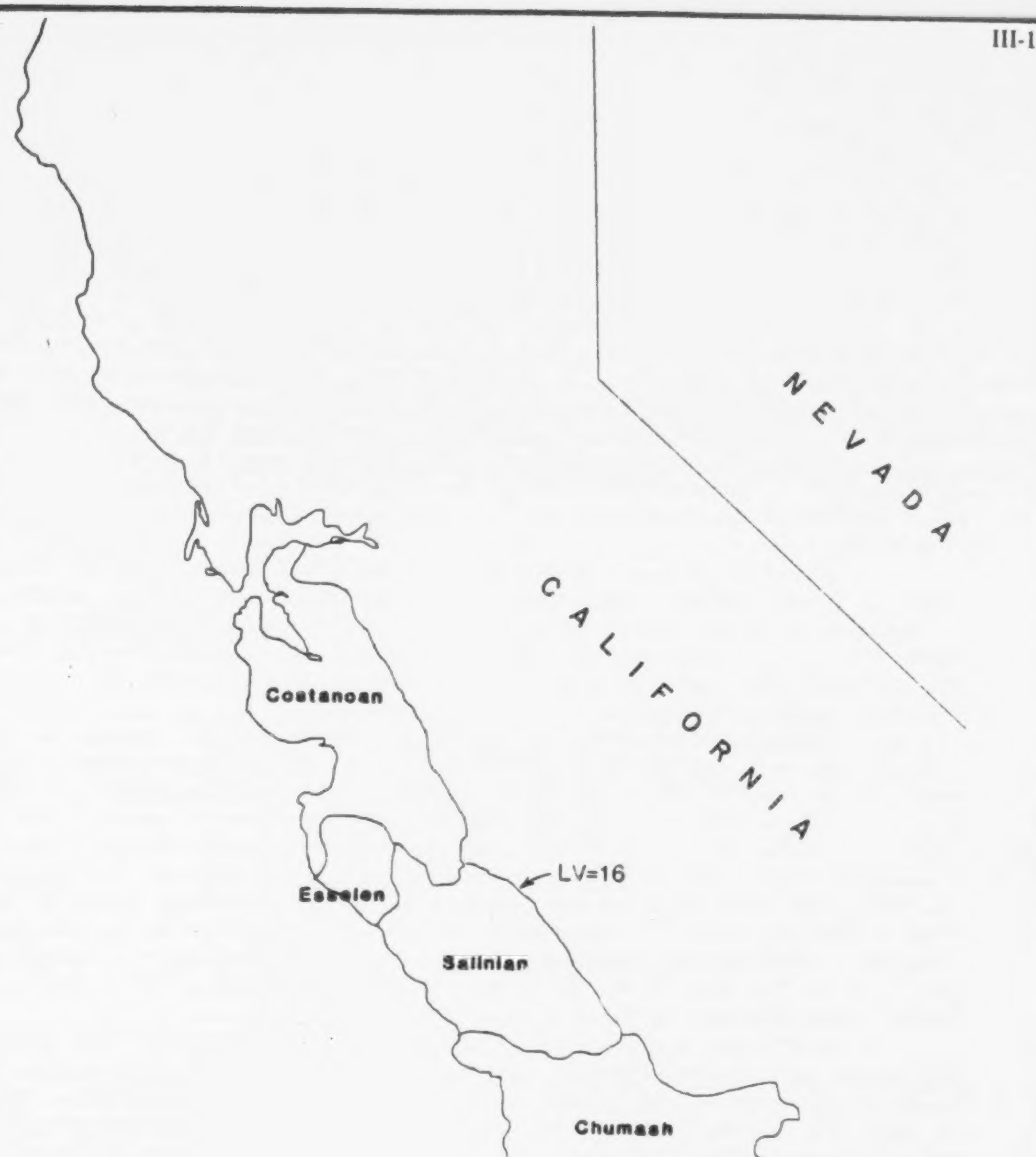

NEVADA
CALIFORNIA
Costanoan
LV=16
Esselen
Salinian
Chumash

Figure III-3. Ethnographic Groups of Central California.

Mission Soledad and Junipero Serra Peak (Hester 1978b:500). Jones et al. (1987) have presented archaeological and ethnohistoric evidence to place the northern boundary on the coast at Big Creek. The western portion of Salinan territory is extremely rugged, with the 1,000-m scarp of the Santa Lucias falling abruptly to the rocky shoreline. East of the Santa Lucias, the terrain is somewhat gentler, and is drained by the San Antonio, Nacimiento, and Salinas rivers.

Subsistence: Vegetable food was gathered from three major biotic communities in Salinan territory: oak and pine forests, found on ridgelines and in the river valleys, furnished pine nuts and six species of acorns, the major staple of the Salinan; grasslands provided several kinds of grass and flower seeds, as well as clover and milkweed; and in the chapparal was found numerous types of berries, as well as chia, prickly pear, soaproot, and wild grapes.

Acorns were stored in granaries near the houses until ready for use, when they were broken open, dried, and pounded in stone mortars. Seeds were gathered with seed beaters and baskets, and also stored until needed; then they were ground with manos and metates (Gibson 1983:29-30).

Mammalian resources included deer, bear, and rabbits (Hester 1978b:501); Gibson (1983:164), citing ethnohistoric data, adds to the list numerous species of rodent, as well as mountain lion, mountain sheep, coyote, and skunk. Birds taken by the Salinan include goose, pigeon, dove, quail, and duck; also eaten were turtles, snakes, and lizards. The interior rivers provided freshwater fish, while the ocean and coast furnished shellfish, sea mammals, fish, crab, and seaweed (Gibson 1983:164).

Settlement: Salinan settlement and land use patterns have been studied by Gibson (1983), who identifies several levels within the general system. Two general and politially distinct dialect areas are identified, consisting of the "Antoniano" on the west and the "Migueleno" on the east; each contained a principal rancheria or village, surrounded by and tied to a number of smaller villages. Each village contained a number of nuclear or extended families. The two principal villages, identified as *Quinau* for the Antoniano and *Cholaam* for the Migueleno, were located near the center of their respective dialect areas as identified by Gibson, who believes this to facilitate access to resources within the dialect areas. The principal settlements were tied by affinal and consanguinal relationships to surrounding smaller villages, each in its own resource procurement area. Resources were stored in the principal settlements, to be disbursed in times of scarcity or during major social events (Gibson 1983).

Hester (1978b:501) states that the Santa Lucias generally lacked permanent occupation sites, though temporary camps should be present. Indeed, most Salinan villages were located in the San Antonio and Nacimiento river drainages, though some occupation sites are known along the coast. Some of the coastal sites are said to have been on the beach, but whether they functioned as occupation sites is unclear. The pattern identified by Jones et al. (1989) during inventory of several thousand acres of coastal Salinan and Esselen territory was that villages probably occupied by the Salinan were located above the fog line but within easy access of both shellfish and acorns; temporary camps, probably used by travellers to the coast, are found in all types of settings.

2.1.3.3 Esselen

Language: The Esselen language is very poorly known, with only limited word lists surviving. It is assigned, on limited data, to the Hokan stock (Shipley 1978:86).

Territory: The Esselen (Figure III-3), one of California's least-known groups, inhabited the drainage of the Carmel River and the rugged coastline along the northern Santa Lucia range. Their territory probably extended from Junipero Serra Peak and Big Creek on the south (Jones 1987) to the drainage of the Big Sur River and a point just north of Carmel Valley on the north (Hester 1978a:496).

Subsistence: Sketchy descriptions of Esselen subsistence activities suggest similarity with those of the neighboring Costanoan groups to the north (Hester 1978a:497). Vegetable foods included the acorn (attested to by the presence of numerous bedrock mortars), buckeye, roots, dandelions, and various seeds. Deer were hunted using disguises, and skunks, dogs, rabbits, and lizards were also eaten. Fishing occurred, but was more intensive when hunting was poor (Costanso 1910); poison made from the wild turnip was used to catch fish. Mussels and abalone were also eaten (Hester 1978a:497).

Settlement: Settlement patterns of the Esselen remain poorly known. Hester (1978b:496-497) notes that Viscaino had described both coastal and inland villages, and that Hodge (1907-1910,1:1438) had noted villages in the higher Santa Lucias. Most presently known Esselen villages were located along the Carmel and lower Big Sur rivers (Hester 1978a:496). Jones et al. (1985:127) note that large village sites near the coast identified in Salinan territory are absent in Esselen territory, where only temporary camps are found.

2.1.3.4 Costanoan

Language: Levy (1978a) has identified eight mutually unintelligible Costanoan languages. Together with the Miwok languages, these belong to the Utian family of the Penutian linguistic stock.

Territory: Costanoan speakers occupied the coastal areas between San Francisco Bay and the Santa Lucias, south of present Monterey, with the eastern boundary of the Costanoan speakers formed roughly by the crest of the Diablo Range (Figure III-3). Speakers of the Chalon branch of Costanoan occupied the lower Salinas River and Chalone Creek drainages; Rumsen speakers lived along the upper Salinas, Carmel, and Big Sur rivers; speakers of Mutsun, the largest Costanoan group, lived in the Pajaro River drainage system; Awaswas was spoken by people living on the coast north of Monterey Bay and in the lower San Lorenzo River drainage; Tamyen speakers occupied the lower San Francisco Bay and Santa Clara River drainage; speakers of Ramaytush lived along what is now the San Francisco peninsula; Chochenyo speakers occupied the east bay and probably the Livermore Valley; and the Karkin speakers, the smallest of the Costanoan groups, lived on the southern edge of the Carquinez Strait. Speakers of Costanoan totalled about 9,800 in 1790 (Levy 1978a:485).

Subsistence: Like most California groups, the Costanoans favored the acorn as their staple food, with tanbark oak preferred but coast live oak and valley oak probably more productive. Also eaten were buckeye and digger pine nuts, grass seeds, and numerous species of berry, as well as a variety of roots and shoots. A variety of large mammals were hunted, including deer, elk, bear, antelope, mountain lion, sea lion, and whale; small mammals consumed included dog, wildcat, skunk, rabbit, and various rodents. Also eaten were several varieties of waterfowl, including several species of duck and goose; fish, including steelhead, sturgeon, lampreys, and salmon; insects; and reptiles. Mussels, abalone, and octopus were gathered along the coast.

Settlement: Costanoan speakers divided themselves into a number of politically distinct tribelets, though the quantity, names, and territories of the tribelets remain unclear. Within each tribelet territory were one or more villages. These, at least among the Rumsen and Awaswas, were located on high ground away from the shore (Levy 1978a:492). Among the coastal groups, the late period settlement pattern suggested by Jones (see above) probably applies: large villages tend to be located farther inland, while temporary camps are found in a variety of settings, including the coast. Many shell middens deposited by Costanoan groups along the coast were probably shellfish collection and processing areas.

2.1.4 Settlement and Subsistence Systems

2.1.4.1 Site Types and Site Distributions

The California computerized archaeological site database used during the MMS study distinguishes 14 attributes of prehistoric sites. These attributes are derived from archaeological site records, and as such represent only those attributes (usually surface) observed and noted by the site recorders; therefore they do not necessarily represent complete inventories of site materials. Nevertheless, if considered in broad form, these data offer some insight into the types of archaeological resources to be expected within the project area. Attribute frequency of the 752 recorded sites within the central California portion of the project area is as follows:

Attribute	No. of Occurrences
Habitation debris	512
Lithic scatter	235
Bedrock milling	88
Burials	57
Hearths/pits	45
Rockshelter/cave	5
Ceramics	5
Petroglyphs	4
Linear features	4
Architectural features	2
Quarries	1
Cache	0
Pictographs	0
Stone Features	0
Other	95
Unknown	81

Of primary interest to our consideration of site distributional patterns is the comparison between sites containing evidence of habitation (e.g., residential sites) versus other, presumably more special-purpose, sites. The above table shows that in the central California portion of the study area, sites interpreted as containing habitation debris account for 68 percent of all recorded sites. In this area, this category probably includes all shell middens, defined as sites containing significant fractions of marine shell. As noted in Section 2.1.2.4 above, and in Section 3.0, however, many researchers in central California believe that many shell middens represent shellfish-processing sites rather than habitation areas, so that the actual proportion of habitation sites in this region may be significantly lower.

Certain other indicators, however, suggest that habitation sites comprise a relatively large portion of the recorded site inventory in central California. The presence of flaked lithics, for example, may help to distinguish habitation sites from shellfish-processing sites since processing sites tend to have very few lithic remains. A total of 166 sites in this portion of the study area are recorded to contain both lithic materials and "habitation debris", accounting for 22 percent of the total number of recorded sites. These most likely are true residential sites. Other attributes suggestive of intensive occupation, such as burials and hearths/pits, are present in many sites, but may be under-represented since they are usually found subsurface.

As discussed in more detail in Section 3.0, available data suggest that habitation sites are found in protected areas of high resource yield, such as embayments, lagoons, lower drainages, or in areas slightly inland, with access to both terrestrial and marine resources. Shellfish-processing camps or stations may be found in more exposed areas of the coastline. Lithic scatters with no associated habitation debris tend to be found further inland, and may represent hunting camps or game processing stations (Jones et al. 1989).

2.1.4.2 Late Pleistocene/Early Holocene Settlement Systems

It is quite evident from the discussions of early Holocene developments above that current thought on subsistence and settlement patterns during this period is highly speculative. This is particularly true of coastal areas, given the rise in sea levels during this time that would have inundated or destroyed any sites located close to the shore. Nevertheless, a handful of apparently early coastal sites, and a better-documented suite of early inland sites, provide clues as to early adaptations along the central coast.

Many early sites in the west, exhibiting similar assemblages and situated on the shores of ancient lakes, are thought to represent a lacustrine adaptation practiced throughout the western Great Basin and much of California. This adaptation, termed the WPLT (Bedwell 1970; Moratto 1984), is very poorly defined, being represented by relatively few, mostly unstratified sites that contain very sparse deposits. Nevertheless, these sites share a distinctive flaked stone industry that includes large percussion-flaked knives, points, and other bifaces, flaked stone crescents, flake and core scrapers, choppers, hammerstones, cores, drills, and gravers; an absence of groundstone tools; and the situation of sites on the shores of ancient lakes or stream channels (Moratto 1984:93).

This tradition is represented by two sites in the southern San Joaquin Valley, about 100 kilometers (km) from the project area. At Ker-116 near Buena Vista Lake, Frederickson and Grossman (1966) recovered from the lowest stratum several large point fragments, crescent fragments, a scraper, knife fragments, and a stone atlatl engaging hook, as well as a variety of faunal remains. The faunal remains are of particular interest and consist of the bones of deer, bird, turtle, and fish, as well as freshwater clamshells; this suggests a diverse hunting and collecting economy that is distinct from the big-game hunting focus that is assumed for the coeval or possibly earlier Fluted Point Tradition.

The relationship of the WPLT and the Fluted Point Tradition (FPT) is at present unclear. Moratto (1984:103) considers it most likely that the WPLT evolved from the FPT as grasslands and shallow lakes developed during the early Holocene. In this view, the FPT is essentially a late Pleistocene adaptation, while the WPLT is an adaptation to the changing conditions of the early Holocene. A connection between the two traditions is implied by the persistence of fluted points in clearly WPLT assemblages.

The WPLT may have a coastal expression in several early sites in southern and central California. This tradition, termed the Paleo-Coastal Tradition (PCT) by Davis et al. (1969), is discussed at length by Moratto (1984), who includes in this tradition the Diablo Canyon sites and the Rancho Park North site near San Diego, which has been radiocarbon dated to ca. 8,300 B.P. The link with the WPLT is that the Diablo Canyon sites are situated in embayments, and the Rancho Park North site is situated near Batuquitos Lagoon, suggesting a connection with the lacustrine orientation of the WPLT. SLO-801 (Figure III-2), near Pismo Beach and dated between ca. 7,210 and 8,660 B.P., is also situated near an embayment and may represent the PCT; however, little is known of this site beyond the early dates (Breschini and Haversat 1988). Mnt-229 on Elkhorn Slough, if the early dates are valid, may also fit in the PCT. In addition to their tendency to locate sites near wetlands, the WPLT and PCT share a similar lithic technology, though the PCT sites also contain such items as pitted stones, bone tools, and shell spoons and ornaments (Moratto 1984:109). The economic focus of the PCT sites is on littoral resources, including numerous species of shellfish, birds, sea and terrestrial mammals, and fish (Moratto 1984). The lack of millingstones at Rancho Park and in the lowest strata at SLO-2 and possibly SLO-585 suggests the lack of use of hard seeds (Moratto 1984), but it should be pointed out that millingstones have been found in apparently early contexts elsewhere in the region. At SCr-177, for example, three large millingstone fragments were excavated from a soil horizon dated to 10,650±180 B.P. (Cartier 1989:89).

It is unclear whether the PCT is a separate and distinct outgrowth of the WPLT, or perhaps simply representative of a seasonal or occasional WPLT presence on the coast. The WPLT seems to have become established somewhat earlier, with the earliest sites dating to ca. 11,000 B.P., while the PCT appears about 9,300 B.P.; both persisted to roughly 8,000 B.P. It is suggested by Moratto (1984) that population pressure in the interior may have caused WPLT populations to move toward the coast, where they found productive environments similar in many respects to the pluvial lakeshores. These coastal environments may have been undergoing increasing productivity at this time, due to the slowing of the sea level rise that had been occurring over the previous several thousand years. This slowing may have allowed coastal ecosystems to mature, increasing productivity and perhaps further stimulating population movements into the region.

But is the PCT, with its bay-and-lagoon economic focus, truly representative of human presence in coastal central California during the early Holocene? It is notable that Moratto's discussion of this tradition is based on only three sites, two of those at Diablo Canyon, the other about 250 miles to the south. Breschini and Haversat (1988) note that four of the seven known early Holocene sites between Monterey Bay and San Luis Obispo were not associated with typical PCT settings, but were situated inland, along marshy creeks or near springs. They suggest that rising sea levels of the early Holocene would have inundated or destroyed most of the esturarine coastal sites, tending to leave intact any sites slightly away from the coast; this would obscure or erase much of the evidence of a possibly extensive tradition.

The remaining early Holocene sites near the central coast SCr-177, SLO-177, SLO-832, and SLO-877) (Breschini and Haversat 1988) are not clearly related to the PCT, since they are (or were) located some distance inland and are not associated with lagoons or embayments. These sites are also less informative with regard to subsistence than the sites near the coast. SCr-177, the most extensively excavated of any early site along the central coast, contains "virtually no shell or bone" (Breshini and Haversat 1988:4), the primary remains consisting of flaked lithics and ground and pecked stone (this may be due to differential presevation). At SLO-177, *Mytilus* appears to dominate throughout the deposit, the base of which was dated to 8290±100 B.P. (Rudolph 1983); the upper levels remain undated, however. Significantly, this site contained millingstones in its lower levels. At SLO-877, which contains a minor early Holocene component below a more extensive mid-Holocene deposit, changes in shellfish frequencies were noted, wherein *Mytilus* dominated during the early occupation while *Tivela* was more common during the mid-Holocene. It is suggested that this either represents a change in coastal environments or simply a change in distances to the coast (Breschini and Haversat 1988).

The picture that emerges of early Holocene subsistence along the coast of central California, then, is that of a generalized economy that is distinct from the big-game focus of the FPT, but similar in many respects to the wetland adaptations of the WPLT found further inland. Available subsistence information from possible representatives of the PCT (SLO-2, -585, and Rancho Park North) indicates that inhabitants of these sites used a wide variety of marine and terrestrial resources. Exploited at Rancho Park North, for example, were 13 molluscan species, as well as abundant fish bone indicating use of both lagoon and littoral species. Also present are minor amounts of waterfowl, deer, rabbits, and rodents (Kaldenberg 1976; Moratto 1984). At SLO-2, a diverse economy is indicated throughout the entire 9,000-year sequence, including sea lion, harbor seal, sea otter, deer, rabbit, bear, badger, mountain lion, cormorant, pelican, and goose, as well as 13 species of fish from the lower levels. As with other early Holocene sites on the central coast (notably SLO-177), *Mytilus* appears to have been the main shellfish resource, comprising about 85 percent of recovered shell (Greenwood 1972; Moratto 1984).

Since so few sites dating to the early Holocene are known, little can be said about settlement patterns during this period. It has commonly been assumed that a residentially mobile "foraging" strategy was followed during this time, with nomadic groups moving between ephemeral camps. While this is probably true of the members of the FPT with its focus on large game, the highly productive lacustrine environments of the WPLT and the lagoons and estuaries of the PCT may have supported a higher degree of sedentism (Moratto 1984). If resources were available year-round in certain environments, a strategy closer to the "collecting" end of the forager-collector continuum might have been followed. In any case, the extremely limited data suggest that settlement during the early Holocene concentrated on lagoons, embayments, and marshy creeks, with only limited use of other areas.

2.1.4.3 Late Prehistoric Settlement Systems

Beginning around 8,000 B.P. a set of archaeological manifestations began to appear in California that were quite distinct from the preceding early Holocene assemblages, consisting of millingslabs, handstones, scraper planes, and other crude tools as well as a general lack of projectile points. These manifestations, known as the Milling Stone Horizon (Wallace 1955) or the Encinitas Tradition (Warren 1968), are most clearly expressed in southern California, but may be represented at sites as far north as the southern North Coast Ranges. For example, such assemblages have been found at Buena Vista Lake (Figure III-2) (Wedel 1941; Frederickson and Grossman 1977), at the Tranquillity site (Figure III-2) (Hewes 1946), Borax Lake (Figure III-2) (Harrington 1948; Meighan 1955; Frederickson 1973), at Lake Berryessa (True et al. 1979), and at Indian Valley (Orlins 1971). Millingstones have also been found in early contexts at SCl-178 and, as noted above, at SCr-177 and SLO-2, possibly indicating a Millingstone presence in these areas as well.

Despite the regional variation seen in Millingstone assemblages, a broad adaptive pattern is nevertheless evident. A heavy reliance on seeds and other plant parts is seen, which is a sharp departure from earlier adaptations, whose assemblages lack millingstones; hunting appears to have been relatively less important, as evidenced by the relatively low occurrence of projectile points; and in certain coastal areas shellfish exploited heavily (Basgall and True 1985), while at some sites shellfish remains are almost entirely absent (Wallace 1978:28).

Clear evidence of a Millingstone (or Encinitas) presence is lacking along the central coast (Wallace 1978:28). For example, Mnt-229 yielded six radiocarbon dates between 6,000 and 7,500 B.P. (out of 29 radiocarbon samples), but no handstones or millingslabs. Indeed, there seems to have been relatively little use of the coast between Morro Bay and San Francisco Bay prior to about 5,500 B.P. A review of recent summaries of radiocarbon dates for sites along the coasts of Monterey and Santa Cruz counties reveals only three sites that predate 5,500 B.P. All three (Mnt-414, 228, and 229), interestingly, are associated with Elkhorn Slough, which is one of the few estuarine environments along this portion of the coast.

Between about 5,500 B.P. and 1,000 B.P., according to Jones et al. (1989; personal communication 1989), there occurred a "profusion" of sites along the Central Coast. Particularly during the early portion of this period (ca. 5,500 to 3,700 B.P.), a strong focus on marine resources is indicated, with sites containing abundant marine mammal, fish, and shellfish remains. Subsistence patterns during this time are perhaps best represented at Mnt-391, a large site on the interior side of the Monterey Peninsula (Cartier 1984). This site yielded 22 radiocarbon dates ranging between 2,210±80 and 4,910±100, along with a large faunal assemblage. Although a thorough analysis of the faunal remains is yet to be reported, preliminary examination indicates that marine mammals comprised a large proportion of the diet; in addition, the artifactual diversity at the site suggests a residential, rather than task-specific, function.

The settlement patterns exhibited by other sites dating to between 5,500 and 3,700 B.P. are further suggestive of a heavy maritime focus. Almost all sites in Monterey County dated to this period are situated on the immediate coastline, the exception being Mnt-1228, located a short distance inland from the coast of Big Sur (Jones et al. 1989:54). These trends, then, would indicate a well-developed maritime economy was in place on the central coast at this time, with a corresponding settlement pattern that emphasized the immediate coastline.

The sudden proliferation in components, dated to after 5,500 B.P. along the central California coast, may be due to several factors. First, it seems likely that many early sites have been destroyed either by rising sea levels during the early Holocene or by subsequent shoreline erosion. Many shoreline sites are actively eroding today, and cliff retreat in central and southern California has been measured at up to 15 cm per year (Norris 1968). While differential site preservation is undoubtedly a factor contributing to this pattern, however, it seems likely that the increase in dated components during this period also resulted from an increase in coastal populations.

This time period corresponds to the stabilization of sea levels at their present levels, and this stabilization may have led to maturation and increased productivity of coastal ecosystems. This productivity in turn may have supported higher populations. This phenomenon is proposed by Bickel (1978) to have occurred in San Francisco Bay (though considerably later). Similarly, Yesner (1988) has suggested that changes in resource availability associated with the stabilization of sea levels may partially account for population increase in the Gulf of Maine.

A related hypothesis is proposed by Glassow et al. (1988) for the Santa Barbara Channel, just south and east of the OCS study area. This hypothesis addresses the problem of subsistence change during the early period, and proposes population growth as a primary factor. Noting the increase in components dating to after ca. 6000 B.P. in the channel, Glassow et al. suggest that this apparent population increase may be due to increased environmental productivity. It is suggested, however, that the increase in productivity may have resulted not from stabilization of ocean levels, but from a decrease in ocean temperature, which would allow the spread of the vast kelp beds along the channel's coastline. An interesting aspect of this hypotheses is that Glassow et al. find evidence of population decrease along the Channel between ca. 7800 and 6000 B.P. (based on the number of dated components), and note that this period corresponds to a period of warm sea temperatures that may have been beyond the tolerance level of kelp.

Between about 3,700 and 1,000 B.P. some economic diversification seems to have taken place, with sites such as Mnt-88 and -478 (Howard 1974) appearing up to a mile or so inland, while some coastal sites, such as Mnt-185 (Cartier 1979), Mnt-282 (Pohorecky 1976), and Mnt-391, continued to be occupied. Although the evidence is unclear, an increase in use of terrestrial resources is suggested. Since many of the coastal sites continue to be occupied, an adaptive shift by a resident population, rather than a population replacement, is most likely (Jones et al. 1989).

Jones (personal communication 1989) further adds that a major settlement change occurring at ca. 1,000 B.P. (within the proposed Monterey Pattern) is currently becoming evident, and is unrepresented in the Breschini and Haversat model. This change, which comes roughly at the Middle-Late period transition, features the abandonment of coastal residential bases, and the establishment of large villages further inland. Sites on the coast during this time tend to be either task-specific sites for gathering and processing shellfish, or small temporary camps with fuller assemblages. The latter are usually quite small (Jones 1988), while the former tend to be larger, but with limited artifact inventories, having probably been exploited directly from the inland village sites. Marine mammals, while still exploited, appear to have been less important, while shellfish continued to be used heavily. Jones suggests that the relocation of villages farther inland may relate to the introduction of acorn use, as villages were located centrally to productive oak groves.

It should be pointed out that the late period pattern described above is typical of a "collector" strategy as defined by Binford (1980) and applied by Thomas (1983), and is consistent with the land use strategy proposed by Breschini and Haversat for the Monterey Pattern, albeit about 1,000 years later. This is also consistent with the findings of Dietz et al. (1988), who conclude that the Mnt-229 results suggest that such a change took place at Elkhorn Slough ca. 800 B.P., during which the forager residential base at Mnt-229 was abandoned and (based on ethnographic data) permanent or semi-permanent villages were established further inland (Dietz et al. 1988:411). It is further pointed out by Dietz et al. (1988) that the Mnt-229 results are in better agreement with the ethnohistoric reconstructions of Levy (1978a), who places the Costanoan entry into the Monterey Bay area at about 1,500 B.P, than with Moratto (1984), who places it about 2,500 B.P.

Current research on settlement and subsistence patterns along the central coast, then, suggests that a foraging strategy was practiced between about 5500 B.P. to roughly 1,000 to 800 B.P. During this time a profusion of marine-oriented sites was established and occupied along the coast, consisting mainly of forager residential bases of relatively homogeneous structure but containing a full range of artifact forms. Occupants of these sites may have been pre-Esselen Hokan speakers, but the linguistic picture remains obscure. This pattern corresponds in its foraging strategy somewhat to the "Sur Pattern" but persists roughly 1,000 years longer. Like the Sur Pattern, it lacks an identifying artifact assemblage.

A major settlement shift occurred about 1,000 years ago that appears to be typical of a "collecting" strategy. This shift saw the establishment of large, complex inland villages, possibly oriented towards increased acorn use. On the coast, two general types of sites appear: small, single-component sites that contain a variety of materials (corresponding to collector "field camps," and larger middens containing abundant shell but a very limited range of artifacts (probably used as non-residential collector "locations" for obtaining and processing shellfish). This pattern is seen both in the Monterey Bay area (Jones, personal communication 1989) and in the coastal Santa Lucias (Jones et al. 1989). Although it conforms in one respect (a collector strategy) to the Monterey Pattern proposed by Breschini and Haversat, this pattern seems to appear about 1,000 years later than the proposed beginning of the Monterey Pattern, and is not as yet clearly related to Costanoan intrusion.

2.2 San Francisco Bay

2.2.1 Previous Research

Systematic archaelogical survey in the San Francisco Bay area began with the work of N.C. Nelson, who between 1906 and 1908 recorded several hundred sites around San Francisco Bay and along the coast between Half Moon Bay and the mouth of the Russian River (Nelson 1909). Of the "shell heaps, earth mounds and... temporary camps" in this region, Nelson concentrated his description on 425 "shell heaps," found mainly around the San Francisco Bay. Nelson's work, while a bit unclear as to methods and site location, is the most comprehensive single survey to date in this region (Moratto 1984:227), forming the basis for much subsequent work and providing important early observations of settlement patterning. He noted, for example, that site locations seemed to vary according to environmental factors, observing that most of the sites were within 50 ft of the bay and were situated on or near small streams. He further noted that the southern portion of the bay contained fewer sites than other areas, suggesting that settlement there was limited by the lack of immediately available terrestrial resources (Nelson 1909:330). Excavations at three of the sites documented by Nelson, at Emeryville (Ala-309), Ellis Landing (CCo-295), and the Fernandez site (CCo-259), provided important data for early models of cultural succession (Moratto 1984:227).

The Emeryville Shellmound (Figure III-4), one of the largest and deepest (9.8 m) sites in the bay area, was excavated in 1902 by M. Uhle, who identified two major components at the site, providing important early evidence of cultural change in the bay region. Subsequent investigators (Schenk 1926), however, rejected this concept, attributing vertical changes in artifact types and shell species to seasonal use by different groups (Moratto 1984:229-230).

The Ellis Landing site (Figure III-4), excavated by Nelson between 1906 and 1908, was also a stratified dual component site. The lower component was later used by Beardsley (1952) to type the Ellis Landing Facies; the upper component was placed in the Emeryville Facies. The Fernandez site, located about four miles south of the Carquinez Strait, was excavated by Nelson and several subsequent investigators. Three components were identified at this site, with the two lower assigned later by Beardsley (1952) to the Ellis and Emeryville facies, and the upper selected as the type component for the Fernandez Facies. This component is considered the best example of a late Augustine manifestation in the east San Francisco Bay (Moratto 1984).

Also worthy of mention are L.L. Loud's 1915 investigations of CCo-298 and CCo-300 (Figure III-4) in the city of Richmond. Loud (1924) found important differences between the two sites, with the smaller site containing many more bird bones, bone tools, ash lenses, and mortars and pestles than the larger site. These differences were attributed to differences in age and environment between the two sites.

Beardsley's 1952 synthesis of central California archaeology expanded the Delta sequence (Lillard et al. 1939) to include the San Francisco Bay region, which had previously been considered to have developed separately (Lillard et al. 1939:61). Beardsley defined a set of zones which divided the coast and central valley; within the zones, several cultural horizons developed, which defined temporal sequences. Provinces within the zones were identified, containing archaeological facies, each made up of inividual components. Beardsley's Early Horizon was not seen to have a clear expression in the Bay Area (Beardsley 1952:102), though subsequent research suggests the presence of an early presence (Elsasser 1978:37).

Beardsley identified three facies within the San Francisco Bay area. The earliest was the Ellis Landing Facies, identified at CCo-295 and occurring during the Middle Horizon; next was the Emeryville Facies, first identified at Ala-309 and comprising the earliest manifestation of the Late Horizon; finally, the Fernandez Facies (CCo-259) was the latest of the three and occurred during the latter portion of the Late Period.

Subsequent to Beardsley's work, evidence was found of an early presence in the Bay Area that is linked with the Windmiller culture in the Sacramento Valley. The University Village site (SMa-77) yielded a date (about 3,150 B.P.) that places it in the general range of Windmiller, but also contained materials more similar to Middle Horizon assemblages (Gerow and Force 1968). Another early date (roughly 3,900 B.P.) was obtained from the lower levels of Ala-307 (Elsasser 1978:41).

Ala-307 (Figure III-4), better known as the West Berkeley site, was, until its destruction, located along the east bayshore near present Berkeley. Based on excavations conducted in 1954 and 1955 at the site, Wallace and Lathrap (1975) identified two components: The upper 1.8 m of the site was ascribed to the Ellis Landing Facies (Middle Horizon), while the lower 3.6 m were found to contain materials similar to the Windmiller Pattern of the Early Horizon, yielding radiocarbon dates between about 3,910 to 2,750 B.P. Elsasser (1978:37-40) proposes the Berkeley Facies to include the West Berkeley and University Village materials, while Frederickson (1973) uses Ala-307 as the type site for the Berkeley Pattern (Moratto 1984:261). Molluscan remains found at the site seem to indicate changes in the character of the bay: the lower levels are dominated by oyster, while virtually no clams occur; in the upper levels, however, clams are dominant. This is seen as evidence of gradual siltation of the bay.

Data from three important sites in the Bay Area, Ala-328 (Davis and Treganza 1959), Ala-12 (Oliphant 1968; Rackerby 1967), and Ala-13 (Rackerby 1967), were analyzed in detail by Bickel (1976) (Figure III-4). It was found, based on radiocarbon dates and artifact types, that Ala-12 and Ala-328 were probably occupied initially between 1000 and 2000 B.C., and Ala-13 by ca.

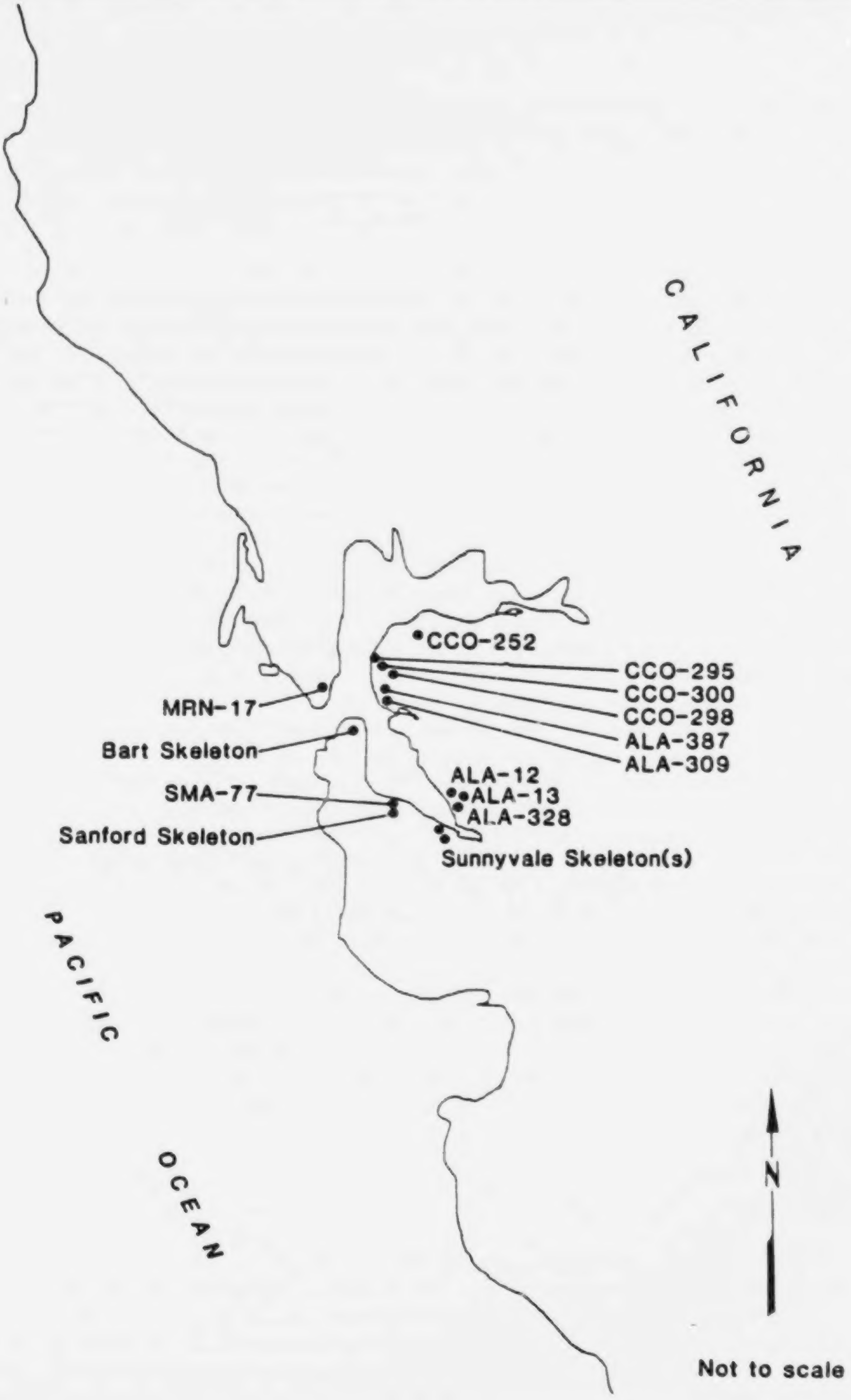

CALIFORNIA
PACIFIC
OCEAN
CCO-252
CCO-295
CCO-300
CCO-298
ALA-387
ALA-309
MRN-17
Bart Skeleton
ALA-12
ALA-13
ALA-328
SMA-77
Sanford Skeleton
Sunnyvale Skeleton(s)
N
Not to scale

Figure III-4. Key Sites Mentioned in Text for San Francisco Bay.

A.D. 300. While changes in artifact assemblages are observable over time in the sites, basic economic patterns seem to have remained essentially the same (Moratto 1984:258).

2.2.2 *Culture History*

2.2.2.1 Late Pleistocene/Early Holocene

Evidence of an expression of the PCT is currently lacking in the immediate vicinity of the San Francisco Bay. To date, the nearest solid evidence of early Holocene PCT presence is at SCr-177 (see above), and possibly at SCl-178, in the southern Santa Clara Valley. To the north, early Holocene materials are found at the Borax Lake site near Clear Lake (see below). The Sunnyvale skeleton (Figure III-4), commonly cited as evidence for Pleistocene occupation of the Bay area (based on an amino-acid date of roughly 70,000 years), has been shown to date to less than 4,000 B.P. based on radiometric methods (Bickel 1978:20).

Given the apparent pattern of early Holocene settlement on estuary and bay shores, a parallel to the inland pattern of lake and marsh use further inland during this period (Moratto 1984:104), it seems reasonable that the newly forming estuaries of the San Francisco Bay would have attracted early populations. The rapid infilling of the bay, however, would have quickly inundated any bayside camps: sea levels, once having entered the Golden Gate at about 10,000 to 11,000 B.P., rose at a rate of about 2 cm per year, spreading inland at a rate of up to 30 m per year. The bay was filled to its present levels by 5,000 to 6,000 years ago (Atwater et al. 1977; Helley and Lajoie 1979).

2.2.2.2 Pre-Utian Hunter/Gatherers

Certain cultural changes observed in the archaeological record may be attributable to movement of Utian groups into the bay region. Moratto (1984) proposes that around 4,500 B.P. the Central Valley was entered by Utian speakers, possibly from either the Western Great Basin or the Columbia Plateau, bringing with them the adaptations of the Windmiller Pattern. By about 4,000 B.P. the Bay Area expression of this intrusion appears, in the form of the Berkeley Pattern as defined by Frederickson (1974). The people occupying the Bay Area at the time of Utian entry into the region, however, remain poorly understood, and relatively few sites have been found that date to before 4,000 B.P.

Evidence of pre-Utian occupation of the bay region has been found within the project area at Mrn-17 (Figure III-4), a deeply stratified midden on DeSilva Island near present Tiburon. Underlying an upper midden at this site is a lower component that has yielded a radiocarbon date of 5,480±125 from a hearth in the basal stratum. Comparison of the upper and lower middens at this site reveals the upper midden to be dominated by bent-nosed clam, while the lower is dominated by bay oyster (Moratto 1984:274); this pattern was noted at Ala-307 in the East Bay (see above), and is seen to indicate changes in the bay environment.

Other discoveries indicative of a pre-Berkeley occupation of the Bay margins consist mainly of isolated skeletons (Figure III-4). The BART skeleton (Henn et al. 1972), discovered in downtown San Francisco during excavation for the Civic Center station of the Bay Area Rapid Transit District (BART), is evidence both for early occupation of the peninsula and for the potential of deeply buried remains under bay silt. Analysis of sediments adhering to the pelvis revealed evidence of both marine and freshwater diatoms, as well as horsetail rush, probable willow, fungus, and various grasses. The environment thus indicated is of a "brackish marsh near or within a channel carrying fresh water from the land, but also covered intermittently by tidal water" (Henn et al. 1972:209). The corrected radiocarbon date for the matrix was about 5,600 B.P. (Moratto 1984:266).

Other ancient skeletons unearthed in the area were found farther from the bayshore. The Sunnyvale skeleton, dated to ca. 70,000 years ago by the amino-acid method, was indicated by several other methods to date to the mid-Holocene (Lajoie et al. 1980:483-486); and the two Stanford skeletons appear to date to about 4400 B.P.

The time period preceding the apparent Utian entry into the bay region is represented in only a very few locations, and specific adaptations and land use patterns of these populations remain poorly known. The peoples inhabiting the bay area at this time are assigned by Frederickson (1974) to the Lower Archaic Period, characterized by an emphasis on the collecting and processing of seeds, and marked by the appearance of millingstones, as well as a relative decrease in the importance of hunting, and relatively little emphasis on fishing or the hunting of sea mammals (Frederickson 1974:46). The discovery of the BART skeleton suggests that the developing bay environment was used, but most evidence regarding the extent and nature of this use is deeply buried beneath bay sediments (Bickel 1978:15).

2.2.2.3 Berkeley Pattern

Subsequent developments in the Archaic Period are assigned by Frederickson (1973, 1974) to the Berkeley Pattern. Included in this pattern are Gerow's "Early Bay" materials from the University Village site (Gerow and Force 1968), along with later Middle Horizon materials. Gerow (1974), it should be noted, does not concur with this assignment, believing that Early Bay complexes share more traits with Windmiller assemblages than with Middle Horizon materials. Within the Berkeley Pattern, Frederickson finds almost exclusive use of cobble mortars and cobble pestles, while use of millingstones and manos appears to have been minimal. Contrasts with the partially coeval Windmiller Pattern in the Central Valley include fewer projectile points, and less emphasis on a polished stone industry than is seen in the Windmiller assemblages, along with a greater emphasis on bone artifacts. The relatively high proportion of grinding implements relative to projectile points, along with the presence of large shell middens, suggests a collecting, rather than hunting, economic emphasis. The mortars and pestles imply use of the acorn, and the relatively larger number of sites than early periods may indicate a larger population (Frederickson 1973:125-126).

The evidence of extensive acorn use (mortars and pestles) and shellfish exploitation (deep shell middens) found in most Berkeley Pattern sites represents an important economic and settlement shift from earlier patterns. This shift is coincident with regional environmental change and may be related to the maturation of the bay estuary. Many of the early Berkeley Pattern components are now well below present bay level, including West Berkeley (Ala-307) and Emeryville (Ala-309), indicating their initial occupation took place prior to complete infilling of the bay (Bickel 1978:12-14). As Bickel points out, sea level rise was too rapid between 8000-10,000 B.P. to support development of marshes in the bay, and even after the rise slowed, much time was required for the development of permanent marshes. Evidence of marsh development in the Sacramento-San Joaquin Delta is lacking until 6,000 B.P., and in some areas of the bay, marsh development appears to be quite recent (Bickel 1978:12).

Several of the early Berkeley Pattern components, specifically at University Village and West Berkeley, show differing subsistence patterns than do later Berkeley Pattern manifestations. These differences are observable primarily in shellfish remains, which are much less well-represented at University Village and the lower levels of West Berkeley than at later sites. These early components also lack the bones of sea otter, which are quite abundant in the upper levels of West Berkeley and at other sites. Bickel (1978:15) believes these differences to indicate that early occupation of the bay was less focused on estuarine resources than were later occupations, and suggests that the subsistence shift may reflect the maturing of San Francisco Bay as a productive estuarine environment around 2,500 B.P.

By about 2,500 B.P. the Berkeley Pattern is seen to have become firmly established in the bay area, and to have spread to surrounding regions, replacing the Windmiller Pattern in the Sacramento Valley and appearing as the Houx Aspect in the north Coast Ranges (Frederickson 1974:46). Moratto (1984:281-282), following King's model for the Utian radiation (King 1971a, 1971b, 1974a), has proposed that population growth resulting from the development of the highly productive bayshore habitat was responsible for the spread of the Berkeley Pattern. Moratto notes that early Berkeley Pattern sites were situated in ecotonal locations near freshwater streams, and with easy access to both esturaine and terrestrial resources, while later Berkeley Pattern settlements were usually smaller and more dispersed. This shift in settlement pattern may have resulted from the "budding off" of smaller groups from the larger settlements when population began to exceed the carrying capacity of the catchment. These processes may also have contributed to the development of more complex social organization, and facilitated the advance of Berkeley peoples into previously occupied adjacent areas (Moratto 1984:282).

2.2.2.4 Augustine Pattern

The transition from the Berkeley Pattern to the Augustine Pattern took place ca. 1,700 to 1,500 B.P. This pattern includes several Late Horizon facies, including the Mendoza and Estero facies in Marin County, and the Emeryville and Fernandez facies in the East Bay (Moratto 1984:283). The development of the Augustine Pattern in central California is associated with the arrival in the upper Sacramento Valley of Wintuan (ancestral Patwin) peoples, who brought with them several technological innovations and mortuary practices (Moratto 1984:211). These traits apparently diffused into the bay area without major population replacement, except in the northeastern portion, where earlier Bay Miwok populations appear to have been displaced by ancestral Patwin.

New technologies seen in the Augustine Pattern seem to have appeared both as outgrowths of the Berkeley Pattern and as local innovations. These include the bow and arrow, shaped mortars and pestles, bone awls, harpoons, tubular pipes, and the *Gunther Barbed* projectile point. Also evident are more general changes, including population growth and a profusion of settlements; increasing development of trade networks; greater status differentiation; and development of secret societies and cults, along with their associated material manifestations. Vegetal foods appear to provide a greater percentage of the diet, with a particular emphasis on acorns. Finally, the later manifestations of the Augustine Pattern show the development of the use of clamshell disk beads as exchange currency (Moratto 1984:283).

No great changes in settlement patterns appear to have taken place, and at many sites Augustine components overlie Berkeley components. Some local settlement changes apparently occurred during this time, however, wherein some portions of settlements appear to have been deserted in some portions of San Francisco Bay and Marin County, with apparent sudden population movements. It may be that, for some reason, groups moved from larger settlements to smaller sites in the surrounding area (Elsasser 1978:43).

2.2.3 Ethnography

2.2.3.1 Costanoan

See previous discussion in Section 2.1.3.4.

2.2.3.2 Eastern Miwok

Language: The Eastern Miwok language group is one of the divisions of the Miwokan subgroup of the Utian language family (Levy 1978b:398). Eastern Miwok is in turn divided into five languages, each spoken within a specific territory (see below) (Figure III-5).

Territory: The divisions of the Eastern Miwok are delineated along linguistic lines. The Northern Sierra, Central Sierra, and Southern Sierra Miwok occupied the Sierra foothills between the Consumnes River on the north and the Fresno River on the south. More relevant to the present project are the Plains Miwok, who lived in the eastern Sacramento River Delta, along the lower Mokelumne and Consumnes drainages and along the Sacramento River between present Rio Vista and Freeport; and the Bay Miwok, who inhabited the area between the Sacramento-San Joaquin delta and present Walnut Creek (Levy 1978b:398).

Subsistence: The most important food to the Plains and Bay Miwok was the acorn of the valley oak, usually gathered from the ground but occasionally knocked from the tree. Also used were digger pine nuts, gathered during the spring and fall, and buckeyes, which were seen as a generally inferior food and used only in times of shortage. Also important were various grasses and roots.

Mammalian resources included the tule elk and pronghorn antelope, hunted using a deer's head disguise; jackrabbits, driven into nets during communal game drives; beaver, squirrels, and wood rats were also eaten. Waterfowl were extremely important to the Plains and Bay Miwok, and were caught either by pulling a net over feeding birds or raising it in front of flying birds.

Salmon were taken using double-pronged harpoons, while sturgeon were caught with hook and line, and whitefish with an obsidian-tipped spear. Also eaten were river mussels, clams, snails, and grasshoppers (Levy 1978b:403).

Settlement: The Miwok divided themselves into wholly separate and politically distict tribelets, each with control over a specific territory and all the resources within it. Within each tribelet was a number of villages, as well as a larger number of campsites occupied at various points of the seasonal subsistence round (Levy 1978b:398). Most of the known settlements of the Plains Miwok were located on natural levees and knolls along major rivers. Seasonal camps were established along smaller drainages during the spring, and temporary camps were occupied for special tasks. The open plains were used for resource procurement but were little occupied (Bennyhoff 1961:147). Settlements of the Bay Miwok were located mainly near the wetlands of the San Joaquin-Sacramento River delta (Levy 1978b:399).

2.2.3.3 Patwin

Language: The Patwin language is one of the three languages in the Wintuan family of the Penutian stock. Numerous dialects were spoken, including Cache Creek, Hill, River, Lake, Tebti, Dahcinci, and Suisun. The portion of the project area occupied by the Patwin was inhabited by Suisun speakers (Figure III-5).

Territory: The Patwin are divided into the Hill and River divisions. They held a large territory which bordered the Nomlaki on the north (above the town of Princeton), and which continued south to San Pablo and Suisun bays. The Hill Patwin occupied the area from the foothill valleys west of the Sacramento Valley to almost Clear Lake; included in this area were numerous intermontane valleys that were heavily occupied. The River Patwin occupied a strip on both sides of the Sacramento River several miles below Stony Creek south to just above the mouth of the Feather River (Johnson 1978:350). The vicinity of Suisun Bay and Benicia is identified by Bennyhoff as belonging to the Southern Patwin tribelets of *Aguasto* and *Tolenas* (Bennyhoff 1961:142-143,146).

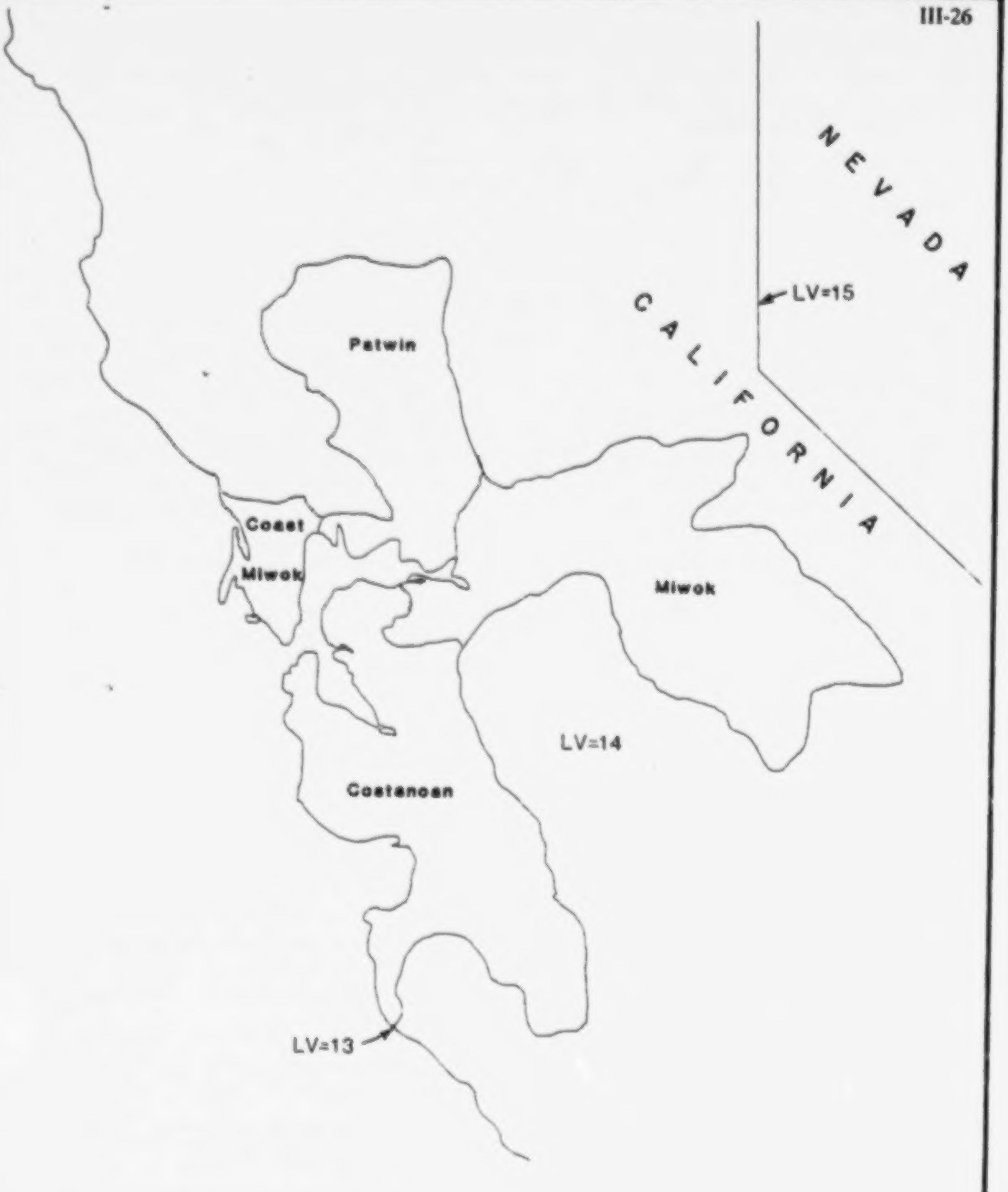

NEVADA
CALIFORNIA
LV=15
Patwin
Coast
Miwok
Miwok
LV=14
Costanoan
LV=13

Figure III-5. Ethnographic Groups of San Francisco Bay.

Subsistence: The subsistence cycle of the Patwin generally approximated that of other central California groups. The staple food was the acorn, and oak groves were communally owned by the tribelet. Other plant foods included blackberries, manzanita berries, juniper berries, and wild grapes, various bulbs, buckeye and pine nuts, and tule roots. Important seed-bearing plants included sunflower, alfilaria, wild oat, and clover. Seed tracts were owned by families.

The hunting of both large and small game also provided a valuable food source. Among the animals hunted were tule elk, deer, bear, antelope, ducks, geese, quail and other birds, turtles, and rodents. Hunting was undertaken either individually or in groups.

Settlement: River Patwin settlements were located on natural levees and low rises along the Sacramento River. Settlements of the Hill Patwin were concentrated in the intermontane valleys to the west of the Sacramento Valley, notably Bear, Capay, Indian, and Antelope valleys, and near springs along the base of the foothills on the west margin of the valley (McCarthy et al. 1982:42). Two tribelet locations (noted above), however, are identified in the Suisun Bay and Benicia area.

2.2.3.4 Coast Miwok

Language: Coast Miwok, a member of the Penutian stock, is divided by Barrett (1908:303-314) into the Bodega (northern) and Marin (southern) dialects. Coast Miwok is closely related to Lake Miwok to the north (Kelly 1978:414) (Figure III-5).

Territory: The territory of the Coast Miwok extended along the coast from San Francisco Bay northward to a point about five miles north of Bodega Bay and about four miles south of the mouth of the Russian River. Their territory extended inland to a point between Sonoma Creek and the Napa River, and included the western margin of San Pablo Bay (Kelly 1978:414).

Subsistence: Acorns of the tanbark oak and the valley oak were the mainstay of the Coast Miwok; other plant foods included buckeye, pepperwood, greens, numerous species of grass seeds, and a few varieties of roots. Salmon were caught in the winter with weirs, dip nets, and spears, and small fish were caught in the intertidal zone during the spring. Surf fish were caught with dip nets, and in the bay fish were caught in seine nets. Eels were caught with poison. Mussels and clams were also an important part of the diet.

Bear, elk, and deer were hunted, as well as smaller animals such as rabbit, cottontail, wood rats, gophers, and squirrels. Both aquatic and land birds were also taken (Kelly 1978:415-417).

Settlement: Villages were for the most part situated near the coast, or along the margins of lagoons and sloughs. Each village contained a number of conical, thatched dwellings that could accomodate up to ten people. Large villages contained a sweathouse, a circular, semisubterrenean structure, and a dance house, also circular and dug into the ground. Villages were occupied through the winter; during the summer, small groups moved into the surrounding hills to gather ripening foods (Kelly 1978:415-416).

2.2.4 Settlement and Subsistence Systems

Several factors offer us great potential for developing synthetic statements about prehistoric settlement and subsistence in the San Francisco Bay area, while several factors serve to restrict our knowledge. In our favor is the long history of archaeological research in the region, beginning with Nelson's survey and excavation work around the bay, and continuing with the work of the University of California Archaeological Survey, as well as the work of Stanford University in the southern bay. Much of this work was conducted in large, relatively undisturbed middens that offered large samples, stratified components, and considerable time depth. Working against us is the extensive and early development that has taken place along the bay that has destroyed many of the most important sites; thus modern excavation and analytical techniques may not be applied to these variously disturbed and destroyed sites. With regard to the early Holocene, the rapid infilling of the bay, together with the siltation caused by the various river systems that flow through the area, has undoubtedly obscured much archaeological evidence.

This discussion of settlement and subsistence systems operating in the bay area draws on previous archaeological research, on general patterns of site occurrence derived from extant records, and on geophysical research on early bay environments.

2.2.4.1 Site Types and Site Distributions

Site attributes derived from California's computerized database suggests a pattern broadly similar to that discussed above for central California. Site attribute frequencies for the 553 recorded sites in the San Francisco Bay region are as follows:

Attribute	No. of Occurrences
Habitation debris	391
Burials	133
Lithic scatter	101
Hearths/pits	37
Rockshelter/cave	35
Bedrock milling	32
Quarries	17
Petroglyphs	13
Stone features	4
Architectural features	2
Ceramics	1
Linear features	0
Caches	0
Pictographs	0
Other	57
Unknown	31

The relative frequencies of these attributes are roughly similar to those described above for central California, with the notable exceptions that quarries are more frequent while bedrock milling is less frequent (both possibly due to local geological factors); and that burials are more frequent in bay sites (24 percent of all sites) than along the central coast (7.5 percent). Again, "habitation" sites are by far the most frequent, although as noted above, shellfish-processing areas would leave remains that superficially resemble habitation debris.

As discussed in more detail in Section 2.0, known sites in the San Francisco Bay portion of the study area are concentrated most heavily around the northern arm of the bay.

2.2.4.2 Late Pleistocene/Early Holocene Subsistence Systems

It is clear from the discussion of the early Holocene Bay area that inferences regarding land use during this period must draw heavily on geophysical evidence, particularly evidence regarding the development of wetlands. The known early Holocene components nearest to San Francisco Bay (Buena Vista Lake, Tulare Lake, Borax Lake, Mostin, and possibly Scotts Valley and Laguna Santa Rosa) are all associated with wetland environments, consistent with the hypothetical adaptations of the WPLT and the PCT. It would seem, therefore, that the early marshes and estuaries of the San Francisco Bay would have offered a favorable habitat for such groups if a productive habitat was present.

In late Pleistocene times, the area now covered by San Francisco Bay was a set of river valleys that drained the Sierra Nevada and portions of the Coast Range. Analysis of core borings of bay sediments taken prior to bridge construction (Atwater et al. 1977) reveal no estuarine deposits in the bay during the period between the Sangamon high sea level stand (ca. 100,000 B.P.) and the early Holocene (ca. 10,000 B.P.). Nor is there evidence of wetlands at the Sacramento-San Joaquin Delta during this time; Pleistocene sediments in this area consist mainly of alluvial deposits from the Sierra Nevada (Atwater and Belknap 1980). Evidence of freshwater marsh, however, has been found underlying later Holocene sediments near present San Francisco. These sediments, comprised mainly of plant remains containing *Scirpus* seeds, probably accumulated in freshwater contexts above the highest tide lines. Available evidence suggests that these marshes terminated somewhere north of present San Mateo (Atwater et al. 1977).

The late Pleistocene environment of what is now San Francisco Bay, then, was that of a set of broad, flat river valleys covered by freshwater marshes or woodlands of Douglas fir or incense cedar, with relatively little oak or redwood. Fossils recovered in the south bay indicate the presence of camels, bison, sloths, and horses (Helley and Lajoie 1979:18).

Between 11,000 and 10,000 B.P., sea level rises associated with the beginning of the Holocene entered the Golden Gate and began to rapidly fill the bay. Until about 8,000 B.P., this rise was extremely rapid, with an average yearly sea level rise of about 2 cm and lineal movements of the shoreline of up to 30 m per year (Atwater et al. 1977; Bickel 1978). This infilling of the bay apparently was too rapid for the formation of extensive salt marshes, which require a balance between sea level rise and sedimentation rates. Analysis of core samples from the bay indicates that before 8,000 B.P., tidal marshes in the San Francisco Bay were small, discontinuous, and unstable, being quickly drowned by the rising sea levels (Atwater et al. 1977).

Since there have been no documented finds indicating human presence in the bay area prior to about 5,000 B.P., any discussion of prehistoric settlement or subsistence during the Late Pleistocene/early Holocene is purely speculative. It is worth noting, however, that the late Pleistocene environment described above is similar to that of Pleistocene Tulare Lake about 80 miles to the southeast, where *Clovis*-like points have been found in possible association with extinct horse, bison, and ground sloth. Moratto (1984:81) ascribes the Tulare materials to either the FPT, which would imply a highly mobile "foraging" strategy, or to the WPLT, which may have involved a somewhat more sedentary adaptation. Since the WPLT is seen as a response to Holocene warming, however, it may be more likely that any Pleistocene remains under the bay would reflect the FPT adaptation.

Late Pleistocene settlements or encampments during this period were probably situated near the margins of the freshwater marshes, or perhaps along the major river courses. Very few data are available on the extent of the freshwater marshes, being limited to the recovery of *Scirpus* seeds from borings near present San Francisco. The marsh system apparently did not extend as far south as San Mateo; its northern extent is unknown.

The early Holocene, between roughly 11,000 and 8,000 B.P., saw the drowning of the freshwater marsh and riverine systems in the bay, but with no replacement by productive estuarine marshes. Bickel (1978) sees the lack of a mature San Francisco Bay estuary as a primary reason for the lack of early archaeological deposits around the Bay. While there may have been prehistoric activity in the area at that time, it was probably not intensive.

2.2.4.3 Late Prehistoric Settlement/Subsistence

Direct evidence of occupation of the bay area begins around 5,500 B.P. Occupation of the bay environment is confirmed at Mrn-17, with its basal date of 5480±125, as well as at CCO-308; and by the BART, Stanford and Sunnyvale skeletons (Figure III-4). Early dates from other sites in Santa Cruz County, Marin County, and the Santa Clara Valley suggest that populations around this time were sparse but widely distributed. Sites dated to between ca. 5,500 and 4,000 B.P. tend to contain relatively few shellfish remains, indicating that shellfish collecting was less important than it was during later prehistory. Subsequent developments during the Middle Period (Berkeley Pattern) saw an increase in population in the bay area, along with an intensification of the use of aquatic resources, a process that continued into ethnographic times (Moratto 1984:283).

Changes in economic and settlement patterns during the prehistory of the bay area may relate to a combination of population growth, environmental change, and population replacement. King (1971a,b, 1974a), for example, proposes a model to explain the development of social complexity in the region that relies on mechanisms attending population growth. According to this model, early sites were situated in ecotonal areas, allowing access to the most productive environments, which in the bay area would have been near marsh areas and freshwater streams, with easy acess to the most productive terrestrial environments as well. As populations increased, pressure on available resources would cause smaller settlements to fission off from the parent community, into more marginal areas. Continued pressure on resources would eventually require new procurement and resource management strategies, including expanded and formalized trade networks, new technologies, increased status differentiation, and generally greater social complexity.

Moratto (1984:281-282) sees King's model as identifying processes by which Utians, associated with the Berkeley Pattern, expanded into the bay area ca. 4,000 B.P. Noting that archaeological evidence of population growth, increased trade, status differentiation and ascription, and the establishment of new settlements during this time are all consistent with King's model, Moratto suggests that the Utians, with their higher population densities and bay/marsh adaptations, may have been able to expand into bay areas already occupied by groups with lower populations and different land use strategies.

The adaptive success of a bay/marsh adaptation in the bay area, of course, is dependent on the development of the extensive marsh systems around the bay into productive ecosystems. Bickel (1978) has explored the potential effects of these changes on human populations, offering possible explanations for several observed archaeological patterns.

Around 8,000 B.P., the rapid infilling of the bay decreased dramatically, having filled perhaps a third of its present southern arm and only a small portion of its northern arm (Helley and Lajoie 1979). This slower rate of infilling allowed the slow development of marsh systems, as well as the establishment of shellfish populations. The absence of known archaeological deposits before about 5,000 B.P. is attributed at least partly to subsequent deposition and inundation; it is noted that the earliest known sites around the bay are buried, and that the BART skeleton was 14 m below the 1850 ground surface.

Bickel also notes changes in subsistence patterns, both in terms of shellfish exploitation and in terrestrial versus estuarine resources. Changes in shellfish frequencies, consisting of a shift from oyster-dominated to clam-dominated shellfish assemblages, have been observed by several previous researchers (Gerow and Force 1968; Gifford 1916; Greengo 1951; Nelson 1909). Bickel sees this change as a consequence of the natural history of the bay where, as the bay matured, increased sedimentation resulted in an increase in the sediment-dwelling clams at the expense of the rock-clinging oysters. Other changes in subsistence remains observed in bay middens involve an apparent intensification of use of estuarine resources. Earlier bay components, such as

University Village and the lower levels of West Berkeley, exhibit relatively fewer shellfish remains and sea otter bones than later components (Emeryville and Ala-328), which contain both in abundance (Bickel 1978:15). Bickel suggests that this intensification, which appears to have taken place about 2,500 B.P. along with the establishment of numerous sites, may signal the maturation of the bay as a productive resource area.

To summarize, it appears that changes in settlement and subsistence in the bay area over the past 8,000 years reflect the interactions of environmental change, population movement, and technological development. Between about 8,000 and 4,000 B.P., the bay was relatively undeveloped as an estuarine environment; prehistoric populations appear to have been sparse, and to have exploited a diverse array of bay and terrestrial resources. Hunting and processing plant foods were important at this time, and shellfish were a relatively minor part of the diet. Sites were established in a variety of settings, including along the bayshore (Mrn-17 on De Silva Island), in the hills east of the bay (CCo-308C), and creek drainages (SCl-613 and SMa-269 in the San Franscisquito Creek drainage).

Around 4,000 B.P., manifestations of the Berkeley Pattern begin to appear in the bay area, representing a distinctive adaptation possibly associated with the expansion of Utian groups into the region. Moratto (1984:282) notes that "virtually all" early Berkeley Pattern sites are situated near coastal or bayshore environments. Terrestrial environments did not go unused during this time; Bocek (1988), for example, documents numerous sites in oak woodland zones in the San Francisquito Creek drainage during this time. Numerous sites around the bay were established around 2,500 B.P., most notably Emeryville and Ala-328 (Bickel 1978:15); these show evidence of intensive use of bay and marsh resources, and may reflect the full establishment of Utian populations in the area, as well as the maturation of the bay as a productive ecosystem.

About 1,600 B.P., the manifestations of the Augustine Pattern are seen, which seem to reflect technological innovation rather than population replacement. Traits associated with Wintuan expansion into the Delta appear to have diffused into the bay area, including the bow and arrow, tubular pipe, and harpoon. More importantly, an increased emphasis on terrestrial resources is evident, particularly the gathering and processing of acorns (Moratto 1984:283).

2.3 Northern California

2.3.1 Previous Research

Previous research pertinent to the prehistory of the northern California coast includes archaeological research of both coastal and inland areas of the north Coast Range, as well as extensive linguistic reconstruction (Whistler 1979) that provides a separate line of evidence against which archaeological data can be compared.

Archaeological research has been particularly sparse on the coast of northern California, with substantial investigations concentrated mainly in the Humboldt area (Elsasser and Heizer 1966; Gould 1966; Heizer and Elsasser 1964; Loud 1918; Milburn et al. 1979) and further south along the King Range (Hildebrandt 1981; Levulett 1985; Levulett and Hildebrandt 1987). Systematic investigation of the north Coast Range was initiated by L.L. Loud of the University of San Francisco, who recorded 172 sites in the lower reaches of the Mad and Eel rivers and conducted excavations on Gunther Island at Hum-167 (Figure III-6), the Wiyot village of Tolowot. Extensive excavations were later conducted at the site by avocationalist H.H. Stuart, whose materials were later examined by Heizer and Elsasser (1964).

Interpretations derived from the Hum-167 materials are summarized by Frederickson (1984), who notes that (1) the lack of evidence for culture change in the assemblage is indicative of occupation by the Wiyot for the site's entire history; (2) grave associations of zoomorphs and large obsidian bifaces, along with evidence for maintenance of exchange networks for ceremonial items (Hughes 1978, 1982), indicates continued social ranking and wealth emphasis; and (3) the distinctive zoomorphs found at the site seem to indicate an influence from the north, and may prove useful in tracing the movement of Algic peoples into California (Fredrickson 1984:487).

Another important site excavated in this portion of the project area was Hum-118, excavated in 1948 by R.F. Heizer and a team from U.C. Berkeley. Located on Patrick's Point in northern Humboldt County, this site was radiocarbon dated to 640±90 and 545±115 B.P. The assemblage of Hum-118 is quite similar to that of Hum-167, with both attributed to the Gunther Pattern. Of particular note in this site's assemblage is the apparent evolution in harpoon tip forms, first identified by Bennyhoff (1950) at this site and later observed throughout the region. Also notable at this site were a number of miniature zoomorphs and bifaces, indicating a ceremonial rather than utilitarian function for these items. Hum-174, a site apparently related to Hum-118, was investigated by the University of California in 1949. This site, situated on a small offshore island near Patrick's Point, contained more than 1,000 sea lion skulls, but no other faunal remains, strongly suggesting some ceremonial function for the site (Heizer 1951).

A few miles to the south on Trinidad Bay, the Yurok village of Tsurai (Hum-169) was investigated by the University of California, also in 1949. The lower levels of this site were found to be similar to the middle levels of Hum-118, implying a later occupation for this site. Abandoned in 1916, this site was estimated to have been first occupied ca. 1620 (Elsasser and Heizer 1966).

Hum-129, the historic Yurok village of Tsahpek located at Stone Lagoon a few miles north of Patrick's Point, was investigated in 1970 by Moratto (1970, 1971), and in 1976 and 1978 by Sonoma State University (Milburn et al. 1979). The faunal assemblage indicate a heavy reliance on sea mammals, while the abundant net sinkers recovered from the site indicate heavy use of lagoon resources, including waterfowl and fish (Fredrickson 1984:490).

All of the sites discussed above are attributed to the Gunther Pattern, with its distinctive late period assemblage and emphasis on marine resources; indeed, few sites in this region contain evidence of earlier adaptations. One exception to this is DNo-11, the Tolowa village of Taiga'n located near present Crescent City (Figure III-6). While the later component (designated Pt. St. George II) at this site is representative of the Gunther Pattern, the earlier component (Pt. St. George I) appears to be pre-Gunther, yielding a radiocarbon date of 2,260±210 B.P. (Gould 1972). The main activity represented by Pt. St. George I appears to be the exploitation of local cherts, with relatively less evidence of use for the maritime resources and greater emphasis on terrestrial game. It has been speculated that this represents use by the ancestral Karok (Whistler 1979).

Some recent work along the northwest coast, particularly relevant to the present project, has been conducted for management of various state and federally owned land units along the coast. Extensive studies in Redwood National Park, for example, have been conducted by Bickel (1979) who followed earlier efforts by Moratto (1971, 1972, 1973). In the coastal King Range, several seasons of field work have been conducted in the Bureau of Land Management King Range National Conservation Area (KRNCA) (Levulett 1985; Levulett and Hildebrandt 1987); survey of the 60,000 acre KRNCA resulted in the identification of 87 sites, of which 57 were found along the coastline. Levulett's work is quite significant with regard to identification of prehistoric land use patterning, and is discussed more fully below. Further south, investigations in Salt Point State Park in Sonoma County (Pritchard 1970; Bramlette and Dowdall 1989) have resulted in the identification of numerous sites, with an apparent shift in site constituents over time that may reflect subsistence shifts. This work, too, is discussed in more detail below.

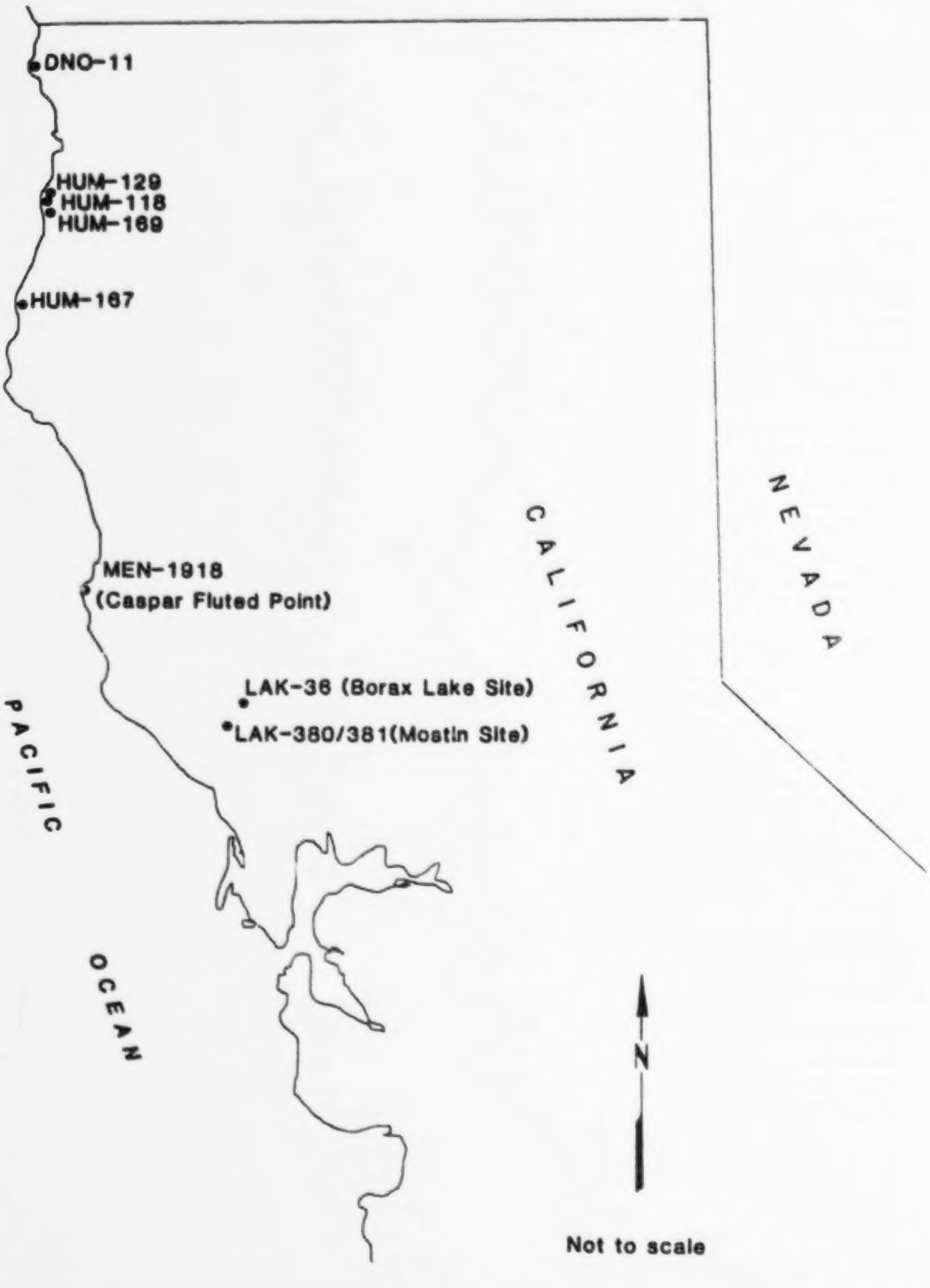

DNO-11
HUM-129
HUM-118
HUM-169
HUM-167
MEN-1918
(Caspar Fluted Point)
LAK-36 (Borax Lake Site)
LAK-380/381(Mostin Site)
CALIFORNIA
NEVADA
PACIFIC
OCEAN
N
Not to scale

Figure III-6. Key Sites Mentioned in Text for Northern California.

2.3.2 Culture History

2.3.2.1 Late Pleistocene/Early Holocene

The discussion above suggests that sustained occupation of the coast of northern California occurred relatively late in time, since no known sites in this area predate about 2,500 B.P. As discussed in Section 3.1.2, however, the lack of known early components in northern California may be due to a number of factors, including the relatively greater width of the early Holocene inundation area along this portion of the coast, differential rates of coastal erosion, or simply fewer archaeological investigations. Evidence of late Pleistocene/early Holocene use of this area does exist, however, in the form of a fluted projectile point found in 1983 at Men-1918 near present Caspar (Simons et al. 1985). This point is the only example of any artifact commonly attributed to this timeframe found along the coast of northern California, and is thus the only tangible evidence of early use of the area (Figure III-6). The Caspar point was found near the surface of a late Pleistocene beach deposit on a low marine terrace about 9 m above present sea level. This deposit is overlain in this area by an apparently recent (but undated) shell midden that is thought to be unrelated to the fluted point. Paleoenvironmental reconstruction of the area indicated that 11,000 years ago, the site lay about 2.6 km from the coastline on a terrace about 4 km in width; surrounding vegetation probably consisted of closed-cone pine forest. This is typical habitat for Roosevelt elk, and it is surmised that this species was the most likely to have been hunted by local populations (Simons et al. 1985:266).

2.3.2.2 Post Pattern

The Post Pattern is defined by Frederickson (1973, 1974) as the cultural manifestation of the Paleo-Indian Period, dated in the north Coast Ranges from ca. 12,000 to 8,000 B.P. This pattern was first identified at CA-LAK-36, located on the margin of now-dry Borax Lake near Clear Lake, where in 1936 Chester Post had found several fluted points (Figure III-6). Excavations by M.R. Harrington (1938, 1945, 1948) recovered numerous lithic artifacts, including fluted points, crescents, and a number of other point forms that he used (based on their superficial resemblance to early forms found elsewhere) to date the site at ca. 10,000 B.P. Subsequent statigraphic analysis and obsidian hydration work by Meighan and Haynes (1970), indicated three periods of use beginning ca. 12,000 B.P. The earliest of these, thought to have lasted from ca. 12,000 to 11,000 B.P., is represented by the Post Pattern, marked by fluted points, single-shoulder points, and crescents, thought to possibly be related to similar assemblages at Buena Vista Lake and Tulare Lake (Frederickson 1974:45, 1984).

Based on the Borax Lake assemblages, Frederickson (1973:212) interpreted the projectile points to indicate a hunting emphasis, and the lakeshore location to suggest use of lacustrine resources as well. The lack of milling tools in the early component was inferred to indicate that seed collecting was less important than hunting, at least those seeds that required milling. Trade networks and social stratification were thought to be undeveloped.

The Paleo-Indian Period is possibly represented at several other sites in the Clear Lake Basin and elsewhere in the north Coast Ranges, but the affiliation of those assemblages with the Post Pattern is unclear. The Mostin site (LAK-380/381) on Kelsey Creek in the southern Clear Lake Basin (Figure III-6), for example, has yielded radiocarbon dates of 11,250±240 and 10,470±490, but with an assemblage that is more compatible with the Early Archaic than the Paleo-Indian Period (Frederickson 1984:523). Outside of the Clear Lake Basin, isolated crescentics have been found at the Laguna Santa Rosa (Origer and Frederickson 1980) and near Bodega. A possible Post Pattern component was identified at Son-547 on Warm Springs Creek (Baumhoff and Orlins 1979); this is one of the relatively few non-lacustrine or marsh-oriented components in the north Coast Ranges that have been identified with the Post Pattern. The Caspar fluted point (Simons et al. 1985) would also be attributed to the Post Pattern, but again appears to have been unassociated with marshland environments.

2.3.2.3 Borax Lake Pattern

The appearance of the Borax Lake Pattern in the north Coast Ranges marks the beginning of what Frederickson calls the Lower Archaic Period. Frederickson's Borax Lake Pattern includes Meighan's Borax Lake and Mendocino complexes, making them early and late manifestations of the Borax Lake and Mendocino aspects of the Borax Lake Pattern. As conceived by Frederickson, then, the Borax Lake Pattern was a particularly long-lasting adaptation, appearing at different times in different regions: manifestations of the pattern appear throughout the Lower and Middle Archaic (ca. 8,000 to 3,000 B.P.), in some areas into the Upper Archaic (3,000 to 1,500 B.P.), and even into the Emergent (1,500 to 100 B.P.) (Frederickson 1984:498).

The early Borax Lake Pattern, a Lower Archaic pheneomenon, is marked by the appearance of the handstone and millingslab, reflecting increased emphasis on the use of seeds; also characteristic of this pattern is the Borax Lake wide-stemmed projectile point. Most data indicate the wide-stemmed projectile point to mark the Lower Archaic (Clewett 1977; Meighan and Haynes 1970; Orlins 1971, 1972; Wickstrom and Frederickson 1982), while the handstone and millingslab persist well into the succeeding Middle Archaic (Frederickson 1984:499). Frederickson (1974) links the cultural developments of the Lower Archaic to the Altithermal, a period of low precipitation when ancient lakes would have dried up, thus causing an adaptive shift in which seed processing was emphasized and hunting became relatively less important. Subsequent research, however, seems to indicate a poor correspondence in some areas between the appearance of the Borax Lake Aspect and the climactic changes brought by the Altithermal (Hildebrandt and Hayes 1983).

The Mendocino Aspect of the Borax Lake Pattern appeared during the Middle Archaic (ca. 5,000 to 3,000 B.P.). Important developments during this time include the appearance of the pestle and bowl mortar (indicating the introduction of acorn processing), and an apparent increase in the importance of hunting. In the southern north Coast Ranges, the wide-stemmed point appears to have been replaced by concave base and leaf-shaped forms, while in the northern Coast Ranges, the wide stemmed point may have persisted later. Frederickson (1984:499) considers this distribution to possibly reflect ethnic affiliation, with the concave base forms representing the Pomo while Yukian groups continued dominance in the north.

Frederickson (1974) links these developments to the climactic changes associated with the Altithermal-Medithermal transition, with its return to moister conditions. Economic diversification is indicated during this time, with acorn processing assuming importance in the north Coast Ranges (though with some possible resistance by Yukian groups), and increased hunting.

2.3.2.4 Berkeley Pattern

The Berkeley Pattern apparently had a limited range in the north Coast Ranges, apparently representing a limited population intrusion (possibly Miwokan) during the Upper Archaic from the bay region to as far north as present Lake County. The Berkeley Pattern is represented in Sonoma and Napa counties by manifestations similar to Bay Area Berkeley Pattern assemblages. In southern Lake County, the Berkeley Pattern is represented by the Houx Aspect, which appears to be a blend of Berkeley Pattern and earlier Borax Lake Pattern characteristics (Frederickson 1984:508). In the southern north Coast Ranges, the Berkeley Pattern featured the introduction of shouldered lanceolate and contracting-stem points, as well as the complete replacement of the mano and metate by the mortar and pestle. Houx assemblages are absent in the northern north Coast Ranges, possibly due to the persistence of Borax Lake Pattern (Hildebrandt and Hayes 1983). Along the northwest coast, few sites of this time depth have been identified, and none are attributed to the Berkeley Pattern (Levulett 1985:70).

2.3.2.5 Augustine Pattern

Archaeological manifestations associated with Frederickson's Emergent Pariod in the north Coast Range include the assemblages of the Augustine Pattern. Frederickson (1974:48-49) sees the Emergent Period in California as a "nonagricultural equivalent of the Formative," in which the environment was modified to increase productivity, food was stored, and complex exchange relationships were developed, as well as complex social and religious structures and status distinctions.

The adaptations characteristic of the ethnographic period appeared during this time. Included in the Augustine Pattern are Meighan's (1955) Clear Lake and Shasta complexes, which in Frederickson's scheme have become the Clear Lake and Shasta aspects. The Clear Lake Aspect is found in the south-central north Coast Ranges (Frederickson's (1984) "Russian River Subregion"), and is identified by slab mortars used with basket hoppers, perforated charmstones, and *Olivella* discs, whole *Olivella*, clamshell, and magnesite beads, along with small corner-notched and side-notched arrow points. The Shasta Aspect, occurring in the Eel River region, is characterized by *Gunther Barbed* arrow points, hopper mortars, large chert bifaces, spire-lopped *Olivella* and pine nut beads, and spindle and phallic-shaped charmstones (Frederickson 1984:496).

2.3.2.6 Gunther Pattern

The Gunther Pattern, the archaeological manifestation of Frederickson's Emergent Period, is found along the far northwest coast of California. Insight into the appearance about 1,000 years ago of the Gunther Pattern is provided by the linguistic reconstructions of Whistler (1979), who associates the appearance of the Gunther Pattern with the entry into the region of the Wiyot, and later the Yurok. Whistler believes the area to have first been occupied by ancestors of the Karok, who at that time pursued a primarily terrestrial-based economy that left the coastal strip relatively sparsely populated. At about 1,000 B.P., the Wiyot settled the coastal strip, following a primarily riverine-oriented economy, and were followed about 800 B.P. by the Yurok, who also followed a riverine economy and settled along the coast and lower Klamath.

It is believed that the Gunther Pattern may represent the specialized adaptation of the Wiyot and Yurok, along with the Karok, who later adopted the new technologies. Gunther Pattern assemblages are identified by *Gunther Barbed* projectile points, several types of harpoon points and spears, stone net sinkers, stone adzes, wedges, and mauls, steatite vessels, shaped pestles, large and small ceremonial bifaces, and distinctive groundstone zoomorphs. The Yurok are thought to have developed the oceangoing canoe, which would have allowed exploitation of offshore rookeries. Gunther Pattern assemblages have been found at Hum-67, -118, -129, -169, and DNo-11. Only DNo-11 contains an apparently earlier component, a sparse and poorly defined assemblage possible associated with the Karok (Frederickson 1984:491).

2.3.3 Ethnography

2.3.3.1 Pomo

Language: The term "Pomo" refers to a group of seven related, but mutually unintelligible, languages spoken by inhabitants of the Clear Lake region and coast north of Bodega Bay. These are among the most complex of the Hokan languages (Figure III-7).

Territory: Considered here are speakers of the four Pomoan language groups situated along the coast: Kashaya, Southern, Central, and Northern Pomo. Kashaya territory, surrounded on three sides by the territory of the Southern Pomo, extended from a point about five miles south of the Russian River north to the vicinity of Stewart's Point, a distance of about 30 miles. This territory included the lower Russian River and the headwaters of the Gualala River, along with the Austin Creek watershed. Most of the territory of the Southern Pomo was located east of Kashaya territory, and extended from the area of present Sebastopol northward about 40 miles to nearly the present Sonoma/Mendocino county line. Speakers of Southern Pomo also inhabited about eight miles of coastline between Stewart's Point and the mouth of the Gualala River.

The Central Pomo language was spoken in an area extending along the coast from the mouth of the Gualala River northward about 35 miles to just north of the mouth of the Navarro river, and east about 40 miles to the ridge system east of the Russian River drainage. Northern Pomo territory extended along the coast from the mouth of the Navarro River north about 22 miles to a point between the drainages of the Noyo and Ten Mile rivers, and eastward about 50 miles to the north shore of Clear Lake (McLendon and Oswalt 1978).

Subsistence: Resources used by speakers of the four Pomoan coastal languages came from two general ecozones: the coast/redwood forest belt and the valley foothill zone (Bean and Theadoratus 1978:289). The coast/redwood forest belt was the least productive of the two, since relatively few resources were available in the redwood forest that grew behind the narrow coastal shelf; most resources in this area came from the ocean, consisting of fish, shellfish, seaweed, sea lions, and salt. Islands a short distance offshore were visited on driftwood rafts for mussels and sea mammals. The redwood forest did provide certain mammalian resources, however, such as Roosevelt elk, deer, and rodents, as well as tree bark used in houses and clothing. Rivers that flowed through the area provided freshwater fish, and acorns were gathered from occasional stands of oak (Bean and Theadoratus 1978:289).

The inland valley foothill zone included the drainages of the Eel and Russian rivers, as well as Sonoma, Petaluma, and Napa creeks. More temperate than the coastal areas, this zone provided abundant vegetable resources, including acorns, buckeye nuts, berries, roots, and numerous varieties of grass seeds. Hunting of deer, elk, and antelope was usually done in groups, and smaller animals were usually trapped or snared. Fish were taken from the streams in this zone, but were less important than on the coast (Bean and Theadoratus 1978:289-290).

Settlement: Settlements in the coast/redwood zone seem to have been influenced heavily by climatic factors and resource availability, with most villages located away from the coastline. Permanent villages among the Kashaya, for example, were located near springs atop the larger ridges, above the dense and rather dank forests, and away from the coastal winds and fog (McLendon and Oswalt 1978:278). Villages further inland within the coastal zone were larger than those along the coast, and many were associated through kinship ties with surrounding smaller hamlets. Most settlements along the coastline and within the redwood forest were seasonally occupied camps, usually occupied yearly by the same kin groups. These were located at the mouths of rivers and creeks, and in certain areas within the redwood forest (Bean and Theadoratus 1978:289).

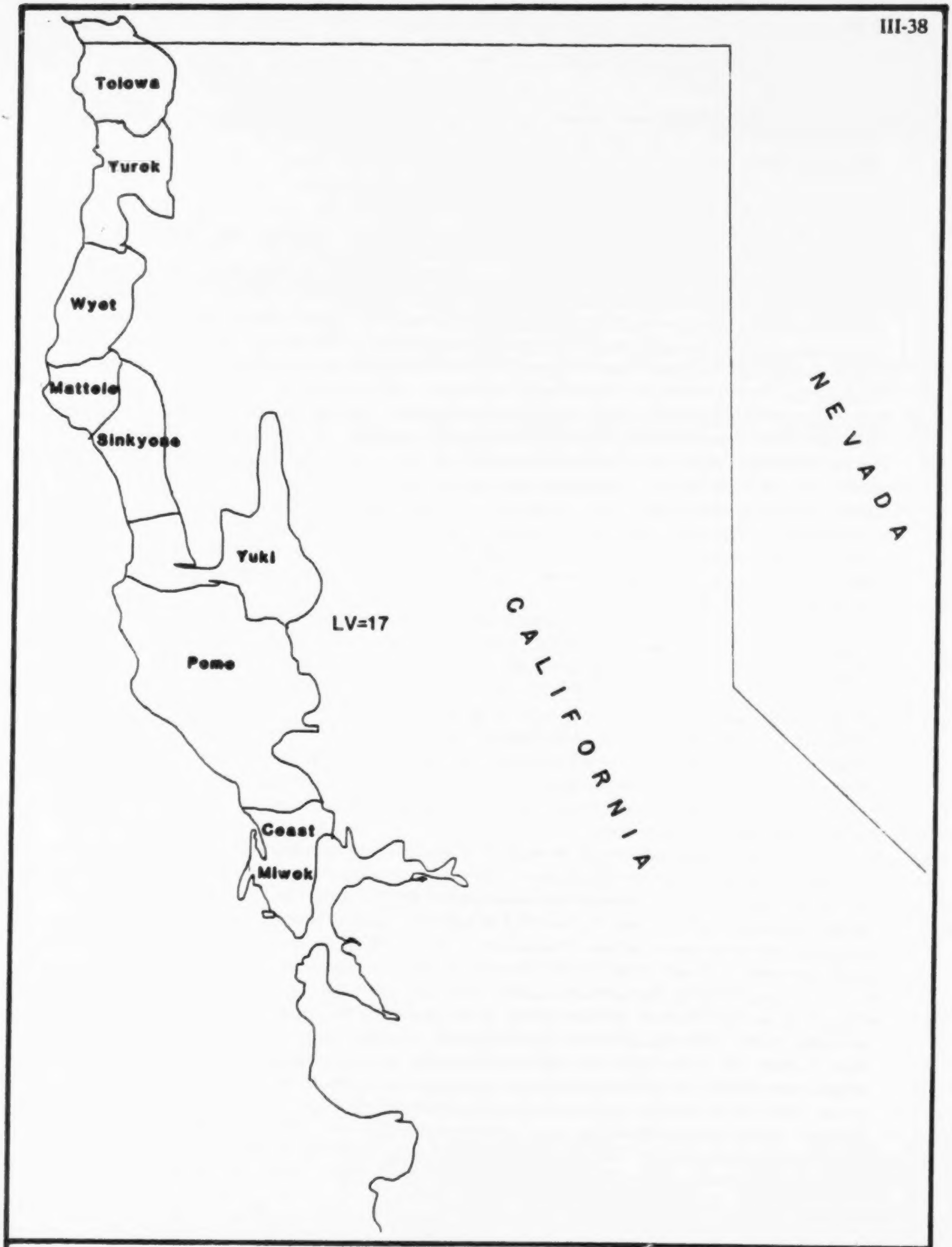

Tolowa
Yurok
Wyot
Mattole
Sinkyone
Yuki
LV=17
Pomo
Coast
Miwok
NEVADA
CALIFORNIA

Figure III-7. Ethnographic Groups of Northern California.

2.3.3.2 Yuki

Language: The lingusistically isolated Yukian language family included the Yuki, Coast Yuki, Huchnom, and Wappo languages. The linguistic affiliations of Yukian are unclear, but the most likely alternative appears to be Elmendorf's (1963, 1964) proposal of a Yukian-Souan-Yuchi link (Shipley 1978:87). Of the Yukian languages, Yuki, Coast Yuki, and Huchnom are very similar, while Wappo is more distantly related.

Territory: Yukian speakers occupying the vicinity of the project area included the Yuki, who occupied most of the drainage of the upper Eel River; the Huchnom, who lived along the drainage of the South Eel River, and, considered in more detail here, the Coast Yuki, who occupied a coastal area extending about 50 miles along the coast and inland about 15 miles (Miller 1978:249) (Figure III-7).

Subsistence: Primary resources of the Coast Yuki were salmon, taken from the South Fork of the Eel River; deer, hunted by individuals using deerhead disguises; acorns, gathered or aquired through trade with the Pomo and Cahto; sea lions and seals, taken with clubs, harpoons, or bow and arrow; mussels; and grass seeds (Miller 1978:255).

Settlement: The Coast Yuki made their winter villages away from the coast. These consisted of a number of conical, bark-covered houses, along with a large assembly house/sweathouse. During the summer, beach camps were made, with simple brush structures serving as shelter. At historic contact, there were eleven Coast Yuki groups, each with a territory that extended inland from the coast to the eastern limits of Coast Yuki territory (Miller 1978:254).

2.3.3.3 Sinkyone

Language: Sinkyone is a dialect of Wailaki, a member of the Athapaskan family (Shipley 1978:90). The similarity of the Athapaskan languages in California suggests a recent entry into the region, probably from the north (Moratto 1984:540). This entry is estimated by Whistler (1979) to have occurred about 600 to 700 B.P.

Territory: Speakers of Sinkyone are divided into the Shelter Cove Sinkyone and the Lolangkok Sinkyone (Elsasser 1978:190-191). The territory of the Shelter Cove Sinkyone included a roughly 40-mile stretch of coastline between Spanish Flat and the mouth of Usal Creek, and extended inland to a point just east of the South Fork of the Eel River (Figure III-7). The Lolangkok Sinkyone held lands north of the Shelter Cove group extending to present Scotia, but with no ocean frontage, which was held in this area by the Mattole.

Subsistence: The primary food resource of the Sinkyone was fish, including king salmon, silver salmon, and steelhead trout, furnished by the Eel and Mattole rivers. Vegetable food resources included acorns, buckeye, manzanita, pine nuts, and berries. Despite the long stretch of shoreline in Sinkyone territory, ocean resources (fish, shellfish, and sea lions) were less heavily relied on. Deer and Roosevelt elk, as well as a variety of small game, were hunted in inland areas.

Settlement: At the time of historic contact, the Shelter Cove Sinkyone were divided into four tribelets with 18 named villages, while the Lolangkok had two tribelets with a total of 50 named villages. Most villages were located along major streams and were occupied primarily during the winter; during the summer, the Sinkyone would break into smaller groups and move into the surrounding hills and forests, occupying temporary camps from which to gather ripening plant foods.

2.3.3.4 Mattole

Language: The Mattole language, also of the Athapaskan family, includes the Mattole and Bear River dialects (Shipley 1978:90).

Territory: The Mattole occupied a coastal area extending from Spanish Flat northward about 20 miles to a point just north of the mouth of the Bear River (Figure III-7).

Subsistence: Subsistence practices of the Mattole were essentially similar to those of the Sinkyone discussed above, with fish comprising the major resource, while ocean resources provided a smaller portion of the diet. Similar vegetable foods were eaten, including acorns, though no significant stands of oak were located in Mattole territory (Elsasser 1978:192).

Settlement: Settlement patterns were again similar to the neighboring Sinkyone, with winter villages along the major streams and smaller, seasonally occupied temporary camps in the hills and forests.

2.3.3.5 Wiyot

Language: The Wiyot language is a member of the Algic stock, an ancient group of languages that includes Wiyot, Yurok, and Algonquian. These three branches are distantly but clearly related, and are thought to have split about 4,000 B.P. (Whistler 1979). Yurok and Wiyot appear to have entered separately into California (Figure III-7), while Algonquian speakers remained in the north-central part of the continent (Moratto 1984:540).

Territory: Wiyot territory covered the broad coastal plain between the Bear River on the south and the Little River about 40 miles to the north. This area included the large estuaries of Humboldt and Arcata bays. Inland, their territory extended about 15 miles to the crest of the first range to the east of the plain (Elsasser 1978:156).

Subsistence: Like many of their neighbors, the Wiyot relied heavily on fishing, both of surf and bay saltwater species and salmon. Shellfish, especially clams, were also important. Primary mammalian resources were deer, elk, sea lion, and, occasionally, beached whales. Since most of Wiyot territory lay in redwood forest, acorns were not readily available, but were traded for with neighboring groups (Elsasser 1978:156).

Settlement: Open coastline was not heavily occupied. The Wiyot preferred to inhabit the quieter margins of Humboldt Bay and the mouths of the Eel and Mad rivers (Elsasser 1978:156).

2.3.3.6 Tolowa

Language: Tolowa is a member of the Athapaskan family.

Territory: The Tolowa occupied an area of roughly 640 square miles in the northwestern corner of California, extending slightly into Oregon (Figure III-7). Their territory extended from the Winchuk River, near what is now the California-Oregon border, southward about 30 miles to Wilson Creek. Territorial boundaries to the east are less clear, but Tolowa groups used areas 15 to 30 miles inland (Gould 1978).

Subsistence: The Tolowa focused their resource exploitation on four distinct habitats: First, the rocky, narrow strip along the coastline provided numerous species of shellfish, including mussels, barnacles and limpets, as well as rookeries for sea mammals and shore birds; sandy beaches provided smelt, and various species of fish were caught offshore from seagoing canoes. The treeless coastal strip just shoreward of the beach provided plants such as edible berries and fibrous plants used for fishnets. The second habitat used by the Tolowa was the redwood forest, located just inland from the coast; this area contained few resources beyond solitary game animals, but provided raw materials for basketry and redwood plank canoes. The third area was the in the mountains east of the redwood belt, which provided abundant acorns. Finally, the riverine habitats of the Smith and its tributaries provided salmon and eels, as well as estuaries that contained waterfowl and tule reeds.

Settlement Pattern: At the time of historic contact, the Tolowa population was concentrated in eight politically distinct villages, each with a defined territory that included a portion of the coastline. All were located near the coast. These villages, containing up to about 300 people, were occupied from about mid-November to midsummer, at which point smaller family groups moved to sandy beaches for smelt, and inland for salmon and acorns. During this time, the villages were frequently visited to deposit food and other materials for storage.

2.3.3.7 Yurok

Language: Yurok is a member of the Algic stock (see discussion of Wiyot above).

Territory: At the time of historic contact, Yurok villages were concentrated along the lower Klamath River and along the seacoast between what is now Trinidad and Crescent City (Figure III-7). Boundaries between Yurok territory and those of neighboring groups are somewhat unclear, and according to Pilling (1978) are primarily defined on the basis of where Yurok tribal law is considered to apply. Briefly, this area is bounded roughly on the north by a point near Wilson Creek, on the east by a point two to three miles up the Trinity River, and on the south by the Little River. Pilling (1978) further notes that in many areas the lands between the Yurok villages and those of neighboring groups are best considered as transitional zones, with no group claiming exclusive rights.

Subsistence: Yurok subsistence focused mainly on fishing and acorn gathering. The major fish resource was salmon, taken with dip nets, seines, gill nets, and harpoons. Sea lions were hunted using disguises, which lured them close enough to harpoon. Deer were occasionally taken with snares. The primary vegetable resource was the acorn, with that of the tanbark oak preferred; also gathered were bulbs and grass seeds. Mussels were gathered from rocks on the coast (Kroeber 1925:84-85).

Settlement: Most Yurok villages appear to have been concentrated along the Klamath River, though several are noted in the vicinity of Big Lagoon and Stone Lagoon, and a few along the open coast. The villages along the river were situated on low river terraces, while the coastal villages are situated along lagoon margins or at the mouths of creeks. Temporary camps in the hills away from the villages were used as bases from which to hunt or gather other resources, but were occupied only for short periods (Kroeber 1925:8).

2.3.4 Settlement and Subsistence Systems

2.3.4.1 Site Types and Distributions

Site attribute frequencies for the northern California portion of the study area, derived from the California computerized site database, are broadly similar to those described previously for central California and San Francisco Bay. Attribute frequencies for the 1,071 northern California sites are as follows:

Attribute	No. of Occurrences
Habitation debris	690
Lithic scatter	166
Hearths/pits	111
Burials	94
Bedrock milling	93

Architectural features	58
Petroglyphs	34
Rockshelter/cave	11
Stone features	6
Quarries	5
Ceramics	2
Pictographs	1
Linear features	1
Cache	0
Other	133
Unknown	168

As is the case with central California and the San Francisco Bay, "habitation debris" is by far the dominant site attribute in the northern California portion of the study area. As previously discussed, however, some of those sites designated as having habitation debris may instead represent task-specific sites for processing shellfish and other faunal resources. As discussed below, both Levulett (1985) and Pritchard (1970) distinguish between shell middens representing habitation and those representing task-specific processing areas. Both researchers suggest that task-specific processing areas tend to be found in outer coastal areas, while residential encampments are usually located in more protected areas. Among the recorded sites in this portion of the study area, only 9.4 percent of the "habitation" sites are recorded to contain lithic materials, further suggesting that many of the sites along the coast represent task-specific sites.

2.3.4.2 Late Pleistocene/Early Holocene Subsistence Systems

Archaeological components in the north Coast Ranges that date to the late Pleistocene/early Holocene are confined to the Clear Lake basin, where the Post Pattern is represented at Borax Lake, and early assemblages have been found at the Mostin site and possibly other sites as well (White 1981). Outside the Clear Lake basin, early materials are limited to a few isolated finds, including a pair of crescentics found near Laguna Santa Rosa (Origer and Frederickson 1980), a crescent found by a private collector near Bodega, and the Caspar fluted point (Simons et al. 1985). It is clear from the scarcity of early remains in the north Coast Ranges that any inferences regarding settlement and subsistence patterns during the late Pleistocene/early Holocene are mainly speculative, and will have to rely as well on general models of early adaptations.

The lakeshore contexts of the Borax Lake materials and the Laguna Santa Rosa crescentics are consistent with the lacustrine adaptations seen for Paleo-Indian assemblages throughout much of California. Similarly, the Bodega crescent was found in the vicinity of extensive esturarine systems near Bodega Bay, and may represent the PCT as defined by Moratto (see above). These adaptations probably focused on a diverse array of lacustrine and estuarine resources, including waterfowl, fish, and various vegetal foods (but apparently no hard seeds), as well as a variety of terrestrial game. While a highly mobile "foraging" strategy is often assumed for Paleo-Indian groups, highly productive habitats such as the Clear Lake Basin or coastal estuaries may have allowed some groups to remain semisedentary and practice a logistically mobile, "collecting" strategy (Moratto 1984).

The Caspar fluted point, however, was not found within a context associated with the WPLT or PCT, being instead situated on a coastal terrace about 2.6 km from the late Pleistocene shoreline. Based on biological, paleoenvironmental, and paleonological data, Simons et al. (1985) consider this artifact to most likely represent exploitation of Roosevelt elk along the coastal plain during the terminal Pleistocene. Although the Clear Lake Basin is only about 50 miles away, the lack of any associated materials would make an association with the Post Pattern unwarranted.

The Caspar point notwithstanding, current evidence suggests that Late Pleistocene/early Holocene populations in the north Coast Ranges were concentrated most heavily around lakes, marshes, and estuaries, a pattern characteristic of the hypothetical WPLT and PCT. The high productivity of these habitats may have allowed a certain amount of sedentism and logistical mobility, but the minimal data for this time period have not demonstrated this. In addition, the Caspar fluted point suggests, at least, sporadic hunting activities along the coast by Paleo-Indian groups, though more intensive use is possible as well. If, as suggested by Simons et al. (1985), the Paleo-Indian economy along the coastal strip did focus on large mammal hunting, then the land use strategy would be more typical of foragers, with high residential mobility of small groups. This would tend to result in limited site inventories often manifested as single, isolated artifacts.

2.3.4.3 Late Prehistoric Settlement and Subsistence

Archaeological remains dating to the later periods of prehistory are rather more abundant, and inferences regarding settlement and subsistence practices can be made with greater confidence. Several models, or at least synthetic interpretations of site function and distribution, have been proposed for areas within the north Coast Ranges, both for interior and coastal areas. The discussion below is not limited to coastal areas, but includes treatment of current knowledge of settlement and subsistence of the interior as well; this is because occupation of the interior appears to considerably predate the occupation of the coast, and is thus important for an understanding of the overall development of prehistoric land use systems in the north Coast Ranges.

A model of settlement and subsistence change for the higher altitudes of the interior north Coast Range is proposed by King (1973), who suggests a settlement pattern shift that is similar in some respects to that seen for the central coast (see above). King postulated that earlier (Borax Lake Pattern) groups tended to be small, with seasonal movement of the entire unit, while groups during later periods were larger and more sedentary, with small task groups exploiting resources from the village bases established at lower elevations. Archaeological manifestations of this shift, then, would be that early sites in higher elevations would contain a wider variety of materials reflective of the activities of an entire social group, while later upland sites would contain a narrower range of tools.

This hypothetical pattern, if present, would represent a shift from a residentially mobile foraging system to a logistically mobile collecting system. T. Jackson (1976), however, has pointed out that King's model is unsupported by ethnographic data, which indicate that many groups moved the entire social units from winter to summer ranges, with comparable spans of occupation for each. Jackson has proposed an alternative model that is essentially atemporal, predicting site locations in space rather than in time. Four major site types are identified: Principal Occupation Sites were occupied during the winter, usually at elevations below 3,500 ft. These are generally located along rivers or near large springs, and are distinguished from other occupation sites by the presence of housepits. Seasonal Occupation Sites are summer range base camps, usually situated above 3,500 ft and occupied by the entire social unit. Temporary Seasonal Camps are temporary campsites established in various procurement areas, at both higher and lower elevations. Finally, Procurement Sites are directed at specific exploitative or extractive tasks, and consist of caches of groundstone, fishing stations, or kill sites. This pattern exhibits both residential and logistical mobility, and is fairly typical of prehistoric settlement systems in California.

More recently, studies along Pilot Ridge (Hildebrandt and Hayes 1983), about 25 miles east of Humboldt Bay, have yielded valuable insights into the development of prehistoric land use systems. Excavation of ten high elevation sites in this area indicates that during early periods (ca. 4,500 to 2,500 B.P.) a foraging strategy was followed in which a wide range of resources were utilized, with particular emphasis on hunting and processing hard seeds. Inter-site variability is low but sites exhibit a variety of activities, apparently reflecting the residential mobility of complete social groups. Between ca. 2500 and 1500 B.P., more specialized use of upland areas is indicated, with low intrasite assemblage diversity indicating specialized procurement or extractive activities. This shift is thought to have resulted from a cooling trend which reduced the availability of upland resources and caused semi-sedentary settlements to be established in lowland areas where storable resources (fish and acorns) were most abundant. A return to warmer conditions in the late period (around 1,500 B.P.) probably increased the productivity of upland areas, resulting in an observed pattern of a slight increase in more diversified use of upland areas; however, the basic "collecting" strategy was maintained (Hildebrandt and Hayes 1983:19.11).

Turning to the coastal areas, all available evidence indicates that intensive use of the coastal strip began relatively late. The earliest known component along the northwest coast is Pt. St. George I at DN0-11, dated to 2,260±210 B.P. (Gould 1972); significantly, this component is quite distinct from later manifestations along the coast, containing little evidence that marine resources were exploited, nor other materials characteristic of the later Gunther Pattern. Frederickson (1984:491), following Whistler (1979), suggests that Pt. St. George I may represent ancestral Karok use of the coast. Later materials along the coast indicate the cultural complexity and heavy reliance on marine resources characteristic of the Gunther Pattern.

Recent studies conducted by Levulett (1985), Levulett and Hildebrandt (1987), and Hildebrandt (1981) have focused specifically on the development and distribution of prehistoric subsistence systems along the northwest coast. Hildebrandt's work examined observed adaptive differences between areas north and south of Cape Mendocino: north of the Cape, it has long been observed, the typical northwest coast adaptation was followed, with its heavy emphasis on marine resources; while south of the Cape a more generalized mix of marine and terrestrial resources was used. Hildebrandt argues that Athapaskan speakers entering the region from the north found the area north of the Cape, with its extensive sea mammal breeding grounds and relatively less productive terrestrial environment, well-suited to their maritime hunting economic adaptation. South of the Cape (more specifically, south of the Mattole River), however, marine mammal habitats were largely absent, while terrestrial resources were more abundant, resulting in a more generalized economy (Hildebrandt 1981:192).

Levulett's research is based on several seasons of field work within the 60,000-acre KRNCA, conducted through a cooperative research agreement between the Bureau of Land Management and research teams from Sonoma State University, Santa Rosa City College, San Jose State University, and the University of California at Davis. A total of 87 sites were identified during survey of the KRNCA, of which 57 were located along the coast and 30 in the interior. The interior sites, it was found, exhibit a high artifact diversity, representing hunting, plant food processing, tool manufacture and rejuvenation, and other activities. Of the interior sites, 23 were situated on ridgelines, while seven were on stream terraces. The coastal sites, in contrast, tend to show a low artifact diversity, with most artifacts appearing to consist of casually manufactured cobble tools, hammers, and anvils (Levulett and Hildrebrandt 1987:26). Both residential sites and food processing stations were identified on the coast, with the latter forming the majority.

Levullett presented a three-phase sequence for the coastal KRNCA which documents gradual intensification of use of marine resources beginning with the initial occupation at about 2,500 B.P. Levulett's sample size is quite small, so interpretations based on this work must be regarded as tentative; nevertheless, certain changes in adaptive patterns are suggested. The earliest period (2,500 to 1,500 B.P.) is represented by few sites on the coast, with relatively little emphasis placed on marine resources. Inland portions of the KRNCA, however, appear to have been occupied some 1,500 years earlier, at around 4,000 B.P. Interior occupation areas at this time contain dense accumulations of a variety of materials, indicating intensive habitation.

During the middle period (1,500 to 700 B.P.), habitation of the coast appears to have increased, though terrestrial resources continued to be emphasized. The late period (700 to 100 B.P.) saw continued increase in coastal occupation, with evidence for intensive use of both marine and terrestrial resources. There is no evidence of year-round occupation of coastal sites; the majority of late sites appear to have been temporary food processing stations, while the late residential camps appear to have been occupied during the spring and summer months (Levulett 1977:188).

Excavation of sites within the KRNCA allowed the development of a coastal site typology (Levulett 1985), in which two general site types were identified. Food-processing stations contain a variety of faunal remains, but limited tool inventories apparently used primarily for butchering and procuring and processing shellfish. These sites are often in exposed areas on the coastal plain, close to water and productive shellfish beds. Residential encampments, on the other hand, are deeper, contain much greater artifact diversity, and tend to be in more protected locations. They also contain burials.

Further south, investigations within the Salt Point State Park in Sonoma County have provided data pertinent to subsistence and settlement studies. Early surveys of the park (Pritchard 1970) revealed two distinct site types: sites with relatively abundant flaked lithics but little shell, and sites with abundant shell but few lithics. It was suggested by Pritchard that the sites dominated by flaked stone represented earlier use of the area than those dominated by shell. It was further suggested that those (hypothetically late) shell middens on the bluffs overlooking the coast represent task-specific areas used by small groups, while larger middens situated some distance away from the bluffs and near the treeline were the main habitation areas occupied by larger groups.

More recent work in the park (Bramlette and Dowdall 1989) is supportive of Pritchard's hypothesis, in that the basic dichotomy of shell-dominated and lithics-dominated sites was found; however, the sites as yet are not firmly dated. It was found, however, that lithics-dominated sites exhibit a much higher artifact diversity than the shell middens along the bluffs, which is suggestive of the better-known patterns observed along the central coast (see above).

Available data from the coastal north Coast Ranges, then, points to a shift from a primarily terrestrial and interior adaptation to increased use of coastal and riverine resources. Early sites in the interior indicate that a wide range of resources were exploited by small, mobile groups (Hildebrandt and Hayes 1983), a pattern typical of a foraging strategy. Some of these earlier sites may have been situated along the coast, but occupation here was not intensive and there was little use of marine resources. Intensification of the use of coastal resources, which began around 2,500 years ago, apparently involved movement towards a logistically mobile collecting strategy. Small, apparently task-specific sites are seen, as well as large, complex occupation sites. The task-specific sites along the coast were apparently used primarily for the processing of faunal resources, and are often situated in exposed areas along the open coastline. Occupation sites are characterized by more diverse artifact inventories, and are situated in protected areas around lagoons, near drainages, or, as noted at Salt Point, near the treeline away from the exposed bluffs.

It is worth noting that, according to Levulett's work, occupation of the coast south of Cape Mendocino was not year-round, being apparently limited primarly to the spring and summer; this is taken to indicate a continuation of terrestrial orientation into the late period. North of the Cape, a heavily marine-oriented adaptation is indicated.

2.4 Oregon

The Oregon portion of the study area is a long narrow strip which includes all but the northernmost portion of the outer coast of the State of Oregon. Specifically, it extends from the Oregon-California state line northward to Tillamook Head in Clatsop County; that portion of the Oregon coast north of Tillamook Head is considered in the discussion of the mouth of the Columbia River. Included for consideration in this coastal zone are all sites located in the immediate vicinity of the outer coast and those major bays and/or estuaries which mark it.

2.4.1 Previous Research

The outer coast of Oregon is a rugged, wild, and only moderately developed area. At the same time, this area has been the principal focus of coastal archaeological studies in the Pacific Northwest. While the prehistoric resources here can hardly be described as well-studied, it is nevertheless true that the current body of archaeological data and interpretation for this area is significantly more developed than that from either the Columbia River mouth or the Washington coast.

In contrast to the latter two areas, the earliest archaeological research to be undertaken on the Oregon coast was conducted in the nineteenth century. The first accounts of archaeological sites here were provided by A.W. Chase who examined shell middens between the Chetco River and Coos Bay on the southern coast in the early 1870s. He described the structure of these sites, proposed a typology for the artifacts within them, and made observations regarding their distribution in the landscape (Chase 1873). Chase's efforts were followed almost immediately by those of Paul Schumacher, which were sponsored by the Smithsonian Institute to investigate sites along the California and Oregon coast. Between 1873 and 1875, he examined a number of sites located between Port Orford and Crescent City, California. Schumacher (1877a,b) described artifacts, burial patterns, and the architecture of aboriginal houses, and offered a synthesis which compared these southern Oregon sites with southern California shell middens near Santa Barbara.

The early pioneering work of Chase and Schumacher was followed by a substantial hiatus in activities and, similar to other coastal areas of the Pacific Northwest, the era of modern archaeological field work on the Oregon coast began with relatively large-scale site survey efforts. While the surveyors sometimes probed into sites, their findings were rarely described in detail and such activities are not considered to be formal test excavations. The first of these occurred in 1935, when Joel V. Berreman of Stanford University undertook a survey of the coast between the Sixes River in Oregon and the Klamath River in California. During this effort, Berreman (1935) recorded 59 archaeological sites, 45 of which are located in Curry County, Oregon.

In 1951 and 1952, Lloyd Collins of the University of Oregon undertook a second large-scale coastal survey intended to complement the coverage provided by Berreman (1935). He examined the Oregon coast between Cape Blanco in Curry County and the Columbia River mouth. A total of 133 archaeological sites were identified by Collins (1953). Several additional large-scale surveys have been conducted since Collins, all of which address state or federal park lands along the Oregon coast. David Cole (1965) of the University of Oregon examined central coast lands to be included in the Oregon Dunes National Seashore. In 1975 and 1976, Dick Ross of Oregon State University directed a survey of state park lands along the coast. This study re-located 40 sites reported during earlier surveys and added an additional 51 sites at this time (Ross 1976a). Archaeological sites on coastal state park lands were evaluated again by Rick Minor of Historic Research Associates in 1984 and 1985; data on 105 sites were now available for consideration (Minor 1986a).

Archaeological site survey activities have been a major part of field work on the Oregon coast during the 1970s and 1980s, but in contrast to the studies cited above, these efforts have become increasingly oriented toward culture resource management and have often been of relatively limited areal scope. Much of the shift has been a consequence of the establishment of state and federal environmental review policies during this period and, in addition to university researchers, several new programs became active as a direct result. Notably, highway survey programs based out of the Museum of Natural History, and then later, the Oregon State Museum of Anthropology, became active by the mid 1970s. Locally based cultural resource consulting companies have also become increasingly active in recent years.

The first systematic archaeological excavations on the Oregon coast were undertaken in the 1930s (Figure III-8). Berreman, after completing his coastal survey, excavated at 35CU37 (the Lone Ranch Creek Site) on the southern coast in 1936 and 1937. His efforts at this large late prehistoric shell midden site included the investigation of four houses and more than 30 human burials; the recovered collection includes 649 artifacts and data on a wide range of faunal materials (Berreman 1944). In addition to a range of stone and bone artifacts, examples of fired clay objects were also recovered here. Berreman compared his archaeological data to Barnett's (1937) cultural elements distribution list for the Oregon coast, and found that his data did not agree almost 20 percent of the time. In 1938, archaeologists from the University of Oregon undertook more limited excavation at 35CS3 (the Bullards Beach Site) near the mouth of the Coquille River (Leatherman and Kreiger 1940). Less than 200 artifacts were obtained during this study.

No archaeological excavations were conducted on the Oregon coast during the 1940s, but efforts by the University of Oregon resumed in the 1950s. The most extensive of these was probably Thomas M. Newman's work at 35TI1 (the Netart's Spit Site), a large shell midden located north of Cape Lookout on Netart's Bay. Excavations at this late prehistoric to early historic site included the investigation of three complete houses and portions of two others; 650 artifacts and a variety of faunal materials were collected (Newman 1959). On the basis of the represented artifacts and house types, he concluded that a culture similar to that of the coast Salish was ancestral to the early historic Indian occupants of this site. Newman's analysis of the prehistory of the Oregon coast also included a much briefer examination of 35CU47 (the Strain Site), a late prehistoric to early historic shell midden near Floras Lake. Several houses were examined here as well, but the scale of this effort was smaller and only 60 artifacts were recovered (Newman 1959). A third site investigated at this time was 35CS5 (the Bandon Site) at the mouth of the Coquille River. The site was first examined by Collins (1953), and Luther Cressman subsequently excavated several late prehistoric to early historic house pits there. While limited accounts of the effort are available (Cressman 1952, 1953), a detailed report of this excavation has never been published.

Archaeological excavations continued into the 1960s with little increase in activity. In 1961, David Cole of the University of Oregon undertook salvage excavations at 35CU61 (the Pistol River Site), a large late prehistoric to early historic shell midden situated on a high bluff overlooking the ocean at the mouth of the river, and at 35CU62 (the Myers Creek Site), an older shell midden located just to the north. Cole's work at the Pistol River Site was followed by Eugene Heflin, who continued to excavate there in 1962 and 1963 (Heflin 1966). Together, Cole and Heflin investigated a considerable portion of this site, examining portions of 18 houses and at least 20 human burials.

The 1970s, however, saw a considerable increase in the pace and range of archaeological activities on the Oregon coast. Several factors probably contributed to this: cultural resource management legislation, increased environmental awareness, and the appearance of Oregon State University as an active player in coastal archaeology. During this period, Dick Ross undertook an extensive program of site testing and larger excavations on state park lands. The first such project was the extended excavation of 35LNC14 (the Seal Rock Site), a large late prehistoric shell midden on the central coast (Snyder 1978; Clark 1988). A similar sustained effort was conducted at 45DO83 (the Umqua-Eden Site), a late prehistoric shell midden near the mouth of

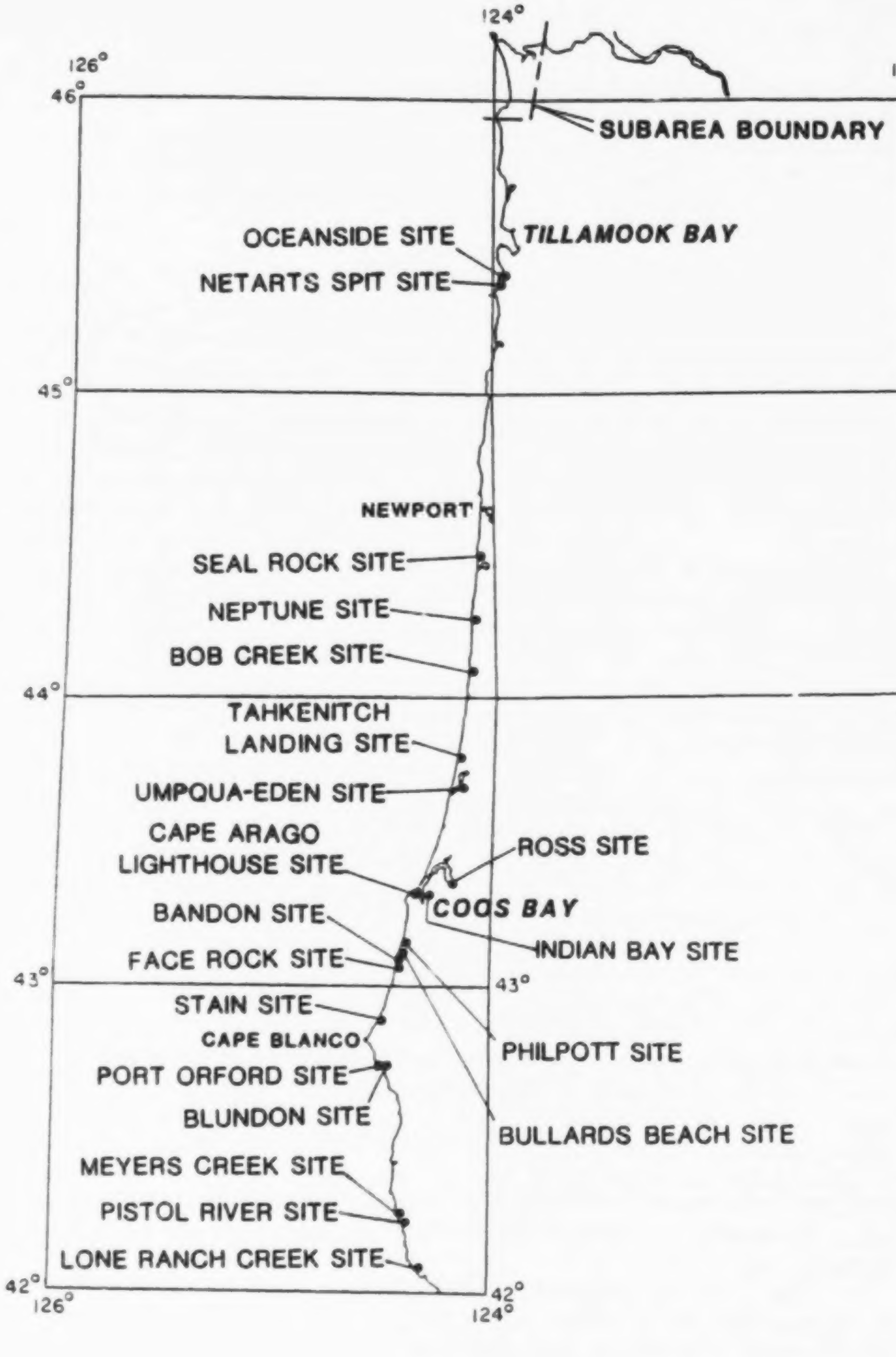

124°
126°
122°
46°
46°
SUBAREA BOUNDARY
OCEANSIDE SITE
TILLAMOOK BAY
NETARTS SPIT SITE
45°
45°
NEWPORT
SEAL ROCK SITE
NEPTUNE SITE
BOB CREEK SITE
44°
44°
122°
TAHKENITCH LANDING SITE
UMPQUA-EDEN SITE
CAPE ARAGO LIGHTHOUSE SITE
ROSS SITE
COOS BAY
BANDON SITE
INDIAN BAY SITE
FACE ROCK SITE
43°
43°
STAIN SITE
CAPE BLANCO
PHILPOTT SITE
PORT ORFORD SITE
BLUNDON SITE
BULLARDS BEACH SITE
MEYERS CREEK SITE
PISTOL RIVER SITE
LONE RANCH CREEK SITE
42°
126°
42°
124°

Figure III-8. Archaeological Sites Mentioned in Text for the Oregon Coast.

the Umqua River (Ross and Snyder 1986). Smaller scale testing or salvage excavation conducted by Oregon State University during this period included activities at 35TI47 (the Oceanside Site) by Zonteck (1978), 35LA3 (the Neptune Site) by Ross (1981), 35LA10 (the Bob Creek Site) by Harrison (1978), 35DO130 (the Tahkenitch Landing Site) by Hartmann (1978), 35CS1 (the Philpott Site), by Draper (1980), 35CS3 (Bullards Beach) by Ross (1976b), 35CS11 (the Cape Arago Lighthouse Site) by Draper and Hartmann (1979), 35CS42 (the Ross Site) by Ross (1981), 35CS45 (the Face Rock Site) by Draper (1988), and 35CU9 (the Port Orford Site) by Ross (1977). All of these sites are similar to the former two; all are shell midden deposits and most are late prehistoric in age.

Still other excavations were conducted the 1970s. In 1970, Ron Stubbs of Southwestern Oregon Community College excavated 35CS30 (the Indian Bay Site), a shell midden deposit on the South Slough of Coos Bay. A late prehistoric to early historic occupation, this excavation recovered almost 300 artifacts and recorded a wide variety of faunal materials (Stubbs 1973). Similar, but more limited, testing was conducted at 35CU106 (the Blundon Site), a multi-component shell midden near Port Orford by Minor in 1979 (Minor et al. 1980).

In the 1980s, the pace of Oregon coast archaeology has slowed somewhat, with Oregon State University continuing its leading role and cultural resource consulting firms undertaking more of the research load. John Woodward of Mount Hood Community College also began studies on the northern Oregon coast at this time. Working at 35TI4 on Newhalem Bay and later at 35TI2 (the Wilson River Site) on Tillamook Bay, Woodward recorded faunal materials, late prehistoric and early historic artifacts, and probable stratigraphic evidence of late prehistoric seismic activity (Woodward 1986; Woodward, White, and Cummings 1990; Woodward, Cummings, and White 1990).

Data from these and other sites suggest that there have been several episodes of subsistence on the northern Oregon coast during the last ca. 2,000 years, but at two of the four localities studied, the seismicity did not result in site abandonment.

In total, this history of archaeological site surveys and excavations has amassed a relatively large body of data relating to the prehistory of the Oregon coast. Within the area, as defined for this study, 274 prehistoric archaeological sites have been recorded and at least limited excavation data is available for 36 of them. Among the latter 36, at least one radiocarbon date is available for 19 of these sites. The studied sites are widely and more or less evenly distributed along the coast, and large geographic gaps in coverage do not occur. Although many of the excavations and related analyses have yet to be reported in detail, at least limited accounts are available for most of these efforts.

While a significant body of data is available, it is important to stress that numerous biases and other inherent limitations impose significant restrictions on the value of much of this data for addressing many important archaeological questions. Several types of biases in the excavation data are probably direct expressions of the actual character of the currently known prehistoric resources of this area. For example, most of the available data is heavily biased toward late prehistoric sites and it is likely that these are the most abundant sites actually present here. Similarly, excavations have been heavily biased toward large shell midden sites and there has been relatively little investigation of other types of prehistoric cultural deposits. While large shell middens undoubtedly do constitute a significant percentage of the sites on the Oregon coast, the heavy bias toward this type of site is also a reflection of the fact that these are among the most visible sites and they are therefore relatively easy to detect. Coastal shell midden sites have also been emphasized because many of the excavations have been salvage efforts, and these sites are often located in places which are subject to either high rates of wave erosion, high rates of development-related disturbance, or both.

Beyond these types of biases, much of the available data suffers from analytical problems. A detailed critique of such problems has recently been offered by Lyman and Ross

(1988); principal limitations they cite include work conducted with implicit (or non-existent) research designs, extremely small artifact sample sizes for many sites, incomplete and inaccurate reporting of data, and ambiguous use of analytical and conceptual terms. At least some of these types of problems are consequences of small-scale cultual resource management testing efforts designed to collect empirical data regarding basic characteristics of a site's physical extent and integrity, and were therefore undertaken without a specific orientation to the resolution of anthropological questions. Given that the Oregon coast has lacked large-scale, long-term cultural resource management projects (such as the river basin studies of the Columbia Plateau), there has been little basis to coordinate and/or integrate the work which has occurred.

2.4.2 Culture History

The culture history of the Oregon coast is only very broadly known. As indicated above, while a substantial body of prehistoric data has been generated here, this data base is nonetheless limited by a number of significant biases. These conditions notwithstanding, it is still possible to sketch at least some of the general character of Oregon coast culture history.

In considering this issue, it is worthwhile to begin by noting that the archaeological community in Oregon has recently prepared a conceptual framework for prehistoric archaeology which includes a generalized chronological scheme of "...universal statewide period definitions" (Gilsen 1989:3). The scheme includes five basic periods: Paleo-Indian, Early Archaic, Middle Archaic, Late Archaic, and Contact. The Paleo-Indian period is the period of human adaptation to, and exploitation of, Pleistocene flora and fauna. The Early Archaic period represents the first adaptations to Holocene conditions during the early post-glacial (Anathermal). The Middle Archaic period represents adaptation to the mid post-glacial (Altithermal) conditions; it is also marked by apparently statewide technological changes such as the appearance of large side-notched points. The Late Archaic period is the period of adaptation to recent (Medithermal) conditions and is marked by the use of small projectile points thought to be associated with the use of the bow and arrow. Finally, the Contact period is defined by the presence of Euro-American artifacts. While highly generalized, and inconsistent in the use of some of its criteria, this chronological scheme is nonetheless a useful framework for considering the culture history of this region.

Against the backdrop of this statewide perspective, it must be acknowledged that there are, in fact, very few proposed cultural chronologies for the Oregon coast itself. To date, there has been only a single such chronology offered for the coast as a whole (Ross 1990; Lyman and Ross 1988), and two additional chronologies proposed for the southern coast alone (Pullen 1982; Minor and Toepel 1983). None include the definition of formal "Phase" units in the sense of Willey and Phillips (1958:22-24). Despite these limitations and differences in scope and interpretation, all three reconstructions are similar in many respects. For the purposes of this presentation, the following account will utilize Ross's chronology with reference to the statewide periods noted above. Aspects of the latter two south coast chronologies will be cited as appropriate. Further, due to data limitations, archaeological materials from other nearby regions will also be considered when they offer potential insights into Oregon coast prehistory.

2.4.2.1 Paleo-Indian

It can be argued that none of these proposed Oregon coast chronologies includes a unit which directly equates with the statewide Paleo-Indian period. In large part, this is probably due to the fact that there is virtually no evidence of such early occupation in the area. The best potential case for a Paleo-Indian presence here is currently a single isolated fluted projectile point found near Siltcoos Lake on the central Oregon coast (Minor 1985:35). The point was not professionally collected and may have been associated with more recent cultural materials; in total, little is known about its circumstances and significance. In more interior areas of western Oregon, several additional isolated fluted points have been reported (Allely 1975; Lalande and Fagan 1982) and, thus, it is entirely possible that they are representatives of the early FPT. Based upon present data, however, it would appear that their presence here was limited.

While not yet reported on the coast itself, there are possible indications of one or two additional Paleo-Indian traditions in nearby areas and similar materials may subsequently be found here as well. For example, in the vicinity of the Columbia River mouth, Minor (1984) has described undated surface materials which he refers to as the Youngs River Complex. These include large rectangular stemmed projectile points which may be representatives of the Stemmed Point Tradition (SPT). Similarly, excavations on the Applegate River in interior southwestern Oregon have produced evidence of an early assemblage marked by projectile points with rectangular stems which may also be related to the SPT (Brauner and Nisbet 1983). Given the current lack of direct evidence, however, the presence of bearers of this tradition on the Oregon coast proper is only speculative. If they were present, the lack of clearer evidence might be cited as an indication that, like the Fluted Point peoples, their presence here was limited.

A very similar situation exists with the Pebble Tool Tradition (PTT). While arguably less distinctive than the large stemmed points of the latter, leaf-shaped projectile points potentially representative of this early tradition occur widely in the Pacific Northwest. Minor's (1984) Youngs River Complex, cited above, also contains examples of leaf-shaped projectile points which may be related to the PTT. Other potential examples of this tradition in western Oregon include components from the Columbia Gorge (Cressman et al. 1960), the Willamette Valley (Newman 1966), the western flank of the Cascade Mountains (Woodward 1972), and along the Rogue River (Davis 1968; Schreindorfer 1987).

Given the presence of similar leaf-shaped forms in later contexts (Connolly and Baxter 1986), it is possible that not all such assemblages are actually associated with the PTT, but some undoubtedly are. In view of radiocarbon dates available from the better documented Pebble Tool sites, it is possible that this tradition is really Early Archaic rather than Paleo-Indian.

2.4.2.2 Pre-Littoral Stage

The earliest cultural-historical unit in the Lyman and Ross (1988) chronology is referred to as the Pre-Littoral stage. As the name indicates, this is seen as a largely terrestrial-oriented adaptation related to early interior sites. Implicit is the suggestion that these peoples had little knowledge of coastal environments and resources. Virtually all of the data which support this concept come from sites on the southern Oregon coast. While very few have been studied, Pre-Littoral occupations are described as lacking shell midden deposits, and a number of them appear to be associated with bluff top settings near the coast. Pre-Littoral assemblages consist primarily of lithic materials and include both chipped and ground stone tools. Projectile points characteristic of the period are generally leaf-shaped, expanding-stemmed, contracting-stemmed and side-notched forms. Other commonly occurring forms include knives, scrapers, and modified flakes. Ross (1990) suggests that such assemblages probably pre-date ca. 3,000 B.P. Elsewhere, Lyman and Ross (1988:98) cite a radiocarbon date of ca. 8,300 B.P. from beneath the shell midden deposits at 35LA3 as evidence of a Pre-Littoral component, but since no diagnostic materials are associated with it, the suggestion is moot.

Based upon the described assemblage contents, and the components cited as representing it, it can be suggested that this Pre-Littoral stage is more or less equivalent to Minor and Toepel's (1983:231) Middle Prehistoric Period and Pullen's (1982:87-90) Early Period for the southern Oregon coast. (In this regard, it should be noted that the former's Middle Prehistoric Period was the earliest temporal unit for which they actually had data; they referred to it as "Middle Prehistoric" on the assumption that evidence of earlier cultures would subsequently be found.) Despite this apparent similarity, both of these latter units were visualized as more recent than Ross's Pre-Littoral Stage. Both Minor and Toepel and Pullen place their units between ca. 3,000 and 1,500 B.P. With respect to the statewide chronological periods, the Pre-Littoral stage would appear to be a representative of the Middle Archaic Period.

There are a number of problems with the Pre-Littoral stage unit. Based almost exclusively on southern coast data, some aspect of the reconstruction appear to be contradicted by recent findings from other parts of the coast. For example, Component I from 35DO130 demonstrates that a variety of marine resources was being utilized at this locality between ca. 8,000 and 5,200 B.P. (Minor and Toepel 1986:104). That this component is not a shell midden deposit only serves to underscore the caution that it is dangerous to assume that maritime activities will always be associated with large quantities of marine shellfish remains. Lyman and Ross (1988:98) suggest that Component I at 35DO130 may represent the Pre-Littoral stage, but given the variety of marine resources present, this assignment is doubtful (see Section 2.4.4.2). Use of shellfish, in addition to a wide range of other marine resources, has been documented at this site beginning ca. 5,200 B.P., further demonstrating an early and sustained maritime adaptation on the Oregon coast.

Ross's interpretation of the bluff top sites which form a part of his Pre-Littoral stage has also proven problematic. A principal limitation in this regard is that has been only very limited direct study of these sites. Ross (1984:248-250) noted that, in fact, there might be some temporal overlap between these non-shell bluff sites and nearby shell midden sites. While accepting that they might represent functionally specific localities of the same peoples associated with the shell middens, differences in the artifact assemblages suggested to him that separate cultural groups were involved. Similarities between the bluff site assemblages and those from more interior settings are cited in support of the view that these sites represent an interior adaptation spreading to the coast. This interpretation has recently been challenged by Minor et al. (1987) who report that 35LNC62, situated on a coastal bluff, contains inter-fingered shell midden and non-shell cultural deposits. These researchers suggest (1987:146-150) that this finding strengthens the case for the non-shell bluff sites being functionally specific localities of the same peoples associated with the shell middens. Draper (1988:260-261) also agrees that this latter interpretation is more plausible, although it must be acknowledged that we lack data sufficient to clearly resolve this issue.

2.4.2.3 Early Littoral Stage

The second cultural-historical unit in the Lyman and Ross (1988) chronology is referred to as the Early Littoral Stage. This unit is visualized as representing the earliest maritime adaptations of the Oregon coast. The authors suggest that there is a direct evolutionary relationship between the Pre-Littoral Stage and the Early Littoral Stage, but they offer no explanation for the dynamics of this change. Unlike the Pre-Littoral stage, Early Littoral assemblages are known from most of the coast. Such collections are, almost invariably, associated with shell midden deposits; some of which contain house pits representing semi-subterranean structures. Early Littoral stage assemblage contents also differ significantly from those of the Pre-Littoral stage. These assemblages are dominated by bone and antler tools, and stone tools are relatively rare. Common bone and antler forms include unipoints, bipoints, unilaterally and bilaterally barbed harpoons of various styles, and wedges. Stone tools include chipped stone projectile points, scrapers, drills, flaked cobbles, atlatl weights, and abrader/whetstones. Projectile points are quite variable, ranging from shouldered and stemmed to a variety of basal, corner, and side-notched forms. While Ross (1990) places the Early Littoral stage between ca. 3,000 and 1,500 B.P., Lyman and Ross (1988:100) acknowledge that such cultures were present by ca. 5,000 to 6,000 years ago.

Correlation of the Early Littoral stage is difficult and the effort underscores the limitations of these units and the available data. Based upon the projectile point styles, it could be argued that this assemblage also bears some relationship to Pullen's (1982) Early Period, despite the fact that the latter's Early Period sites are clearly unlike most Early Littoral stage sites. A similar situation exists in comparison to Minor and Toepel's (1983) Middle Prehistoric period, although in this case the fit is better. While the above-noted suggestion of an equivalence between these latter units and Ross's Pre-Littoral stage results in a temporal mismatch, an equation with the Early Littoral stage offers a somewhat better temporal agreement. Given the available data, the Early Littoral stage unit also could be considered a representative of the statewide Middle Archaic period.

It should be apparent that some of the problems with the Early Littoral stage are directly related to the above-noted problems with the preceding Pre-Littoral stage. Perhaps most striking are the temporal uncertainties; few well-documented dates are available and thus the temporal boundaries are vague at best. As indicated above, Lyman and Ross (1988) identify Component I at 35DO130 as Pre-Littoral, but it contains clear evidence of significant maritime activities and is better considered to be a representative of the Early Littoral stage. While the small sample of artifacts associated with this component differ somewhat from a "typical" Early Littoral assemblage, to characterize this adaptation as Pre-Littoral is misleading.

Uncertainties regarding the significance of the Pre-Littoral stage and the nature of its relationship to the Early Littoral stage are also a major problem. In light of the evidence of ancient maritime activity cited above (i.e., Component I at 35DO130), it is becoming increasingly unlikely that the purported Pre-Littoral stage components actually pre-date early maritime adaptations. Thus, it is difficult to see the Early Littoral stage as having been derived from the currently known Pre-Littoral stage developing adaptations to the coastal environment. One of two other alternatives may represent a better interpretation of the known Pre-Littoral culture components. They may represent functionally distinct sites occupied by the same peoples represented in the shell midden sites, as suggested by Minor et al. (1987) and Draper (1988). On the other hand, they could represent the sites of a separate, contemporaneous, interior-oriented culture which was also present in coastal areas of southern Oregon; Ross's (1984) discussion includes this alternative. The currently available data are not sufficient to resolve this issue.

2.4.2.4 Late Littoral Stage

The Late Littoral stage is the final prehistoric unit in Lyman and Ross's (1988) proposed chronology. It is seen as a direct development out of the preceding Early Littoral stage. Also associated with shell middens, these sites tend to be larger and possibly more permanent occupations. They are present on all portions of the Oregon coast. Late Littoral components are the best-documented prehistoric cultures on the coast and, perhaps for this reason, they exhibit the clearest case for regional distinctions within the area. The Late Littoral assemblage is marked by large numbers of both bone and antler tools and stone tools. Common bone and antler forms include unipoints, bipoints, composite toggling harpoons, fish hooks, lures, wedges, pendants, and gaming pieces. Stone tools include small chipped stone projectile points (thought to be arrow points, as opposed to the earlier atlatl points), scrapers, drills, gravers, modified flakes and pecked and/or ground stone netsinkers, mauls, and abrader/whetstones. Evidence of regionalism on the coast at this time is best seen in projectile point styles. On the southern coast, a variety of concave-based, triangular, and tanged (barbed) forms are prominent; the latter is the so-called *Gunther Barbed* point also common to late prehistoric sites in interior southwestern Oregon and northwestern California (Leonhardy 1967). To the north, small triangular-stemmed forms, more like the Lower Columbia River area, are well-represented. Lyman and Ross (1988) place the appearance of the Late Littoral stage at ca. 1,500 B.P.

Given the relatively good data for this period, correlation of the Late Littoral stage with other proposed units is simple. The Late Littoral stage is unquestionably equivalent to Pullen's (1982.87) Late period and Minor and Toepel's (1983:231) Late Prehistoric period. Both of these latter schemes agree that this development is in place by ca. 1,500 B.P. The recent temporal range, and the inferred presence of bows and arrows, clearly indicate that the Late Littoral stage is a representative of the statewide Late Archaic period. Another benefit of this comparatively good data base is that the Late Littoral stage unit is relatively free of the conceptual and temporal uncertainties which plague the earlier units.

2.4.3 Ethnography

While the Lyman and Ross (1988) chronology does not include an early historic unit, the statewide temporal scheme does conclude with the Contact period and, as such, a brief consideration of the ethnographic peoples of the Oregon coast is appropriate here. Though massively impacted by diseases and other early historic Euro-American-introduced conditions, they are clearly the direct descendants of the bearers of the Late Littoral Stage. The ethnographic peoples of the Oregon coast have traditionally been considered to be members of the Northwest Coast Culture Area, although they are invariably cited as a southern subarea or extension which lacked many of the "classic" Northwest Coast traits (Kroeber 1939; Drucker 1955).

The ethnographic peoples of the Oregon coast (Figure III-9) represent three major language groups, in which a number of more local tribal or band groups may be recognized within each. From north to south, the major language groups represented are Salishan, Penutian, and Athapaskan. Salishan speakers ranged from Tillamook Head to Siletz River country; they included the Nehalem, Tillamook, Nestucca, Salmon River, and Siletz tribes. South of the Siletz, the Penutian speaking Alsea, Suislaw, and Coos tribes extended to the vicinity of the mouth of the Coquille River. The southern Oregon coast Athapaskan speakers included a number of small groups often combined under the names Kwatami, Tututni, and Chetco; the Chetco Territory extending into a small portion of northwest California. Estimates of early Contact period populations prepared by Mooney (Kroeber 1939:136) indicate that these Oregon coast groups may have represented as many as 18,000 individuals. Given that introduced diseases may have reached this area from California slightly prior to this time (Boyd 1985), a significantly larger late prehistoric population may have been present.

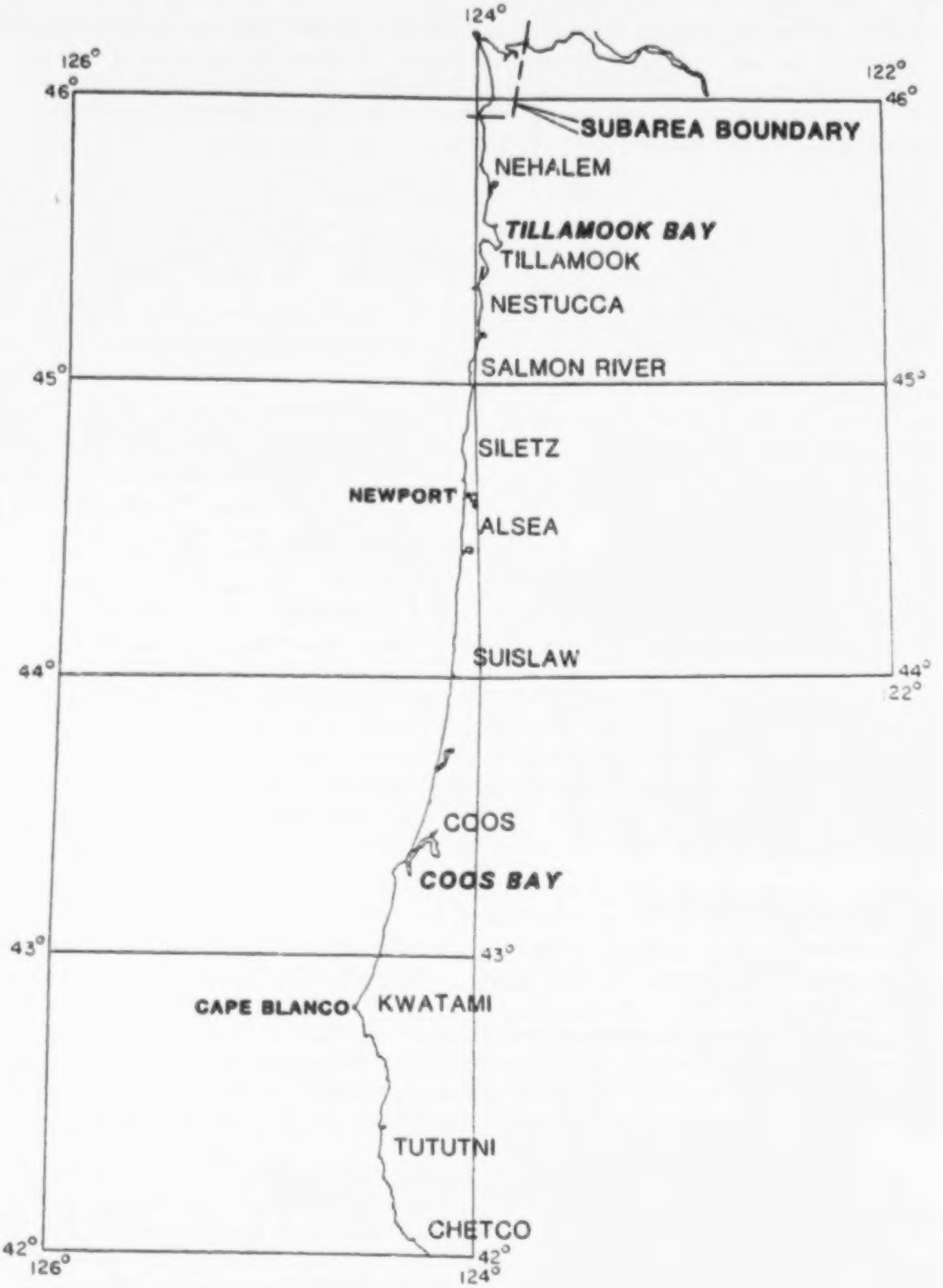
Ethnographic descriptions of these groups are highly uneven in scope, content, and credibility. Some groups are the subject of numerous accounts and others are virtually undocumented. For this reason, the following summaries of the language, territory, subsistence, and settlement patterns collectively consider two or more adjacent groups. Such "lumping" is only conducted when the available data suggests a high degree of similarity among the groups; in some cases, a poorly documented group or groups are considered together with a better-documented neighbor. This approach is not intended to suggest that such amalgamations necessarily represent a single tribal entity.

2.4.3.1 Kwatami/Tututni/Chetco

Language: All three of these groups spoke Athapaskan languages (Hoijer1960). Several different Athapaskan languages were present in southwestern Oregon and adjacent northwestern California, but specific accounts of their character and distribution are unclear.

Territory: Collectively, the southern coast Athapaskans occupied all of the Oregon coast south of the mouth of the Coquille River.

The southernmost of these were the Chetco who occupied the Chetco River and Winchuck River watersheds and adjacent coastal areas (Swanton 1952:59-60). To their north,


124°
126°
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46°
SUBAREA BOUNDARY
NEHALEM
TILLAMOOK BAY
TILLAMOOK
NESTUCCA
SALMON RIVER
45°
45°
SILETZ
NEWPORT
ALSEA
SUISLAW
44°
44°
122°
COOS
COOS BAY
43°
43°
CAPE BLANCO
KWATAMI
TUTUTNI
CHETCO
42°
126°
42°
124°

Figure III-9. Ethnographic Groups of the Oregon Coast.

Tututni groups occupied the lower reaches of the Rogue River and coastal areas including the Pistol River watershed (Swanton 1952:75-76). Finally, the Kwatami held the coast from the vicinity of Four Mile Creek in southern Coos County south to a point beyond Port Orford.

Subsistence: These groups exploited a wide range of marine, riverine, and terrestrial resources, but lacking the large protected bays and estuaries which mark most of the Oregon coast, they may have been more strongly marine-oriented than other Oregon groups. According to Drucker (1937), salmon and acorns were dietary staples, but many other resources were also important. Beyond salmon, fish such as steelhead, sturgeon, smelt, and a wide variety of nearshore marine species were also taken in large numbers. Marine shellfish and waterfowl were important, as were large terrestrial mammals such as deer and elk. The harbor seal and sea lion were important, but there are few indications of the use of pelagic mammals and most marine hunting appears to have occurred in relatively nearshore settings. With respect to plant resources, a wide range of nuts, berries, roots, and sprouts were eaten, but only acorns appear to have been of major importance.

Settlement: All of the south coast Athapaskans moved seasonally, dividing their time between relatively large stable villages and smaller seasonal resource-oriented camps (Drucker 1937:232). Local populations were most strongly concentrated in the villages during the winter months, but these communities probably retained at least some residents throughout much of the year. The principal structure of the village was a split-cedar plank building which housed an extended family unit. The structure was horizontally planked with a gable roof and a shallow rectangular pit dug in the center of the floor. In addition to such dwellings, Athapaskan villages often contained smokehouses and sweathouses; these latter were similar to dwellings in basic form, although sweathouses were often entirely subterranean. As compared to more northern plank structures, Athapaskan houses tended to be smaller and, thus, villages consisted of relatively larger numbers of such structures. Villages were invariably situated near water, on high promontories along the coast proper, at the mouths of rivers and streams, and inland at important confluences along rivers and streams (Draper 1988:66). Seasonal resource camps were relatively small settlements with temporary pole-frame structures. They were oriented toward particular resources and included shellfish collecting camps, acorn collecting camps, terrestrial game hunting camps, and those associated with fish weirs or other types of specialized fisheries.

2.4.3.2 Alsea/Suislaw/Coos

Language: All three of these groups spoke Penutian languages; some or all of these languages have sometimes been referred to under the family name Yakonan (Thompson 1973:990-994). A number of different languages and dialects were present, the specific number and internal relationships again being a matter of some debate. Two languages were spoken among people generally referred to as Coos: the Hanis and Miluk. Immediately to the north, dialects of the Suislaw language were spoken by Suislaw and Lower Umpqua peoples. Still further north, Alsea and Yaquina, either closely related languages or dialects of the same language, were spoken by groups here collectively referred to as the Alsea.

Territory: Collectively, the Oregon Penutians occupied all of the coast between the mouth of the Coquille River and the mouth of the Yaquina River. The southernmost of these, the Coos, held the coast from the mouth of the Coquille River north to a point beyond Coos Bay (Swanton 1952:62, 66). North of the Coos, Suislaw and allied groups occupied the coast over most of what is now Douglas and Lane counties. To their north, Alsea groups occupied the Alsea River and Yaquina River watersheds and adjacent coastal areas (Swanton 1952:55, 80).

Subsistence: Again exploiting a wide range of marine, riverine, and terrestrial resources, these groups differed somewhat from their southern Athapaskan neighbors in that they were more estuarine, rather than marine, oriented (Farrand 1901; Drucker 1939; Harrington 1942).

Salmon, taken largely with traps and weirs, were the most important part of their diet; other significant fish included herring, smelt, lamprey, flounder, and perch. Marine shellfish, marine mammals, terrestrial mammals, and birds were also taken, but none appear to have approached fish in relative importance. The people also collected a wide variety of plant foods in the form of berries, nuts, roots, and sprouts. Acorns were eaten, but they do not appear to have been as important as in southern Oregon.

Settlement: Like most of their neighbors, central Oregon coast people moved between relatively large stable villages and smaller seasonal resource-oriented camps. As villages were usually located along protected coastal estuaries with easy access to many resources, these communities appear to have been occupied through much of the year (Drucker 1939:82-86). The principal structure of the village was a split-cedar plank building which housed an extended family. The structure was horizontally planked with a gable roof and a shallow rectangular pit dug in the center of the floor. Seasonal resource camps were relatively small settlements occupied mostly in the summer and fall. Marked by temporary pole-frame structures, they were oriented toward particular resource activities such as acorn collecting or terrestrial game hunting; most may have been in interior settings.

2.4.3.3 Nehalem/Tillamook/Nestucca/Salmon River/Siletz

Language: These groups were the Salishan speakers of the Oregon coast. All spoke a single language and only a few dialects were present (Thompson 1973:1007-1008). According to Edel (1939), there were two principal dialects: Siletz in the south and Tillamook in the north.

Territory: Overall, the Oregon Salishan speakers occupied all of the coast between the Siletz River and Nehalem River watersheds. Each of the groups occupied a local territory which was roughly equivalent to a coastal river watershed and nearby coastal areas; in most cases, the river bears the group's name. Thus, from the south: the Siletz held the Siletz River, the Salmon River people held the Salmon River, Nestucca held the Nestucca River, the Tillamook held Tillamook Bay and the Tillamook River, and the Nehalem controlled lands to the north as far as the vicinity of Tillamook Head.

Subsistence: Subsistence patterns of the Oregon coast Salishan speakers appear to have been very much like those just described for their Penutian-speaking neighbors to the south. While exploiting a wide range of marine, riverine, and terrestrial resources, they appear to have been oriented primarily toward estuarine environments (Boas 1923; Sauter and Johnson 1974). Salmon, taken largely with traps and weirs, were probably the most important part of their diet; a relatively wide range of other marine fish was also taken with nets, harpoons, and hook-and-line rigs. Marine shellfish, marine mammals, terrestrial mammals, and birds were also taken, but none appears to have approached fish in relative importance. These people also collected a wide variety of plant foods in the form of berries, nuts, roots, and sprouts. Acorns were eaten, but they do not appear to have been as important as in southern Oregon.

Settlement: Consistent with the above-noted subsistence observations, settlement patterns of the Oregon coast Salishan speakers also appear to have been much like those just described for their Penutian-speaking neighbors to the south. The Oregon coast Salishan speakers moved between relatively large stable villages and smaller seasonal resource-oriented camps and, as the villages were usually located along protected coastal estuaries with easy access to many resources, these communities may have been occupied through much of the year. The principal structure of the village was a split-cedar plank building which housed an extended family. With respect to architecture, the structure was much like other coastal Oregon plank houses except that the shed roof, rather than the gable roof, was favored. Seasonal resource camps were relatively small settlements occupied mostly in the summer and fall. Marked by temporary pole-frame structures, they were oriented toward particular resource activities such as acorn collecting or terrestrial game hunting; most may have been in interior settings.

2.4.4 *Settlement and Subsistence Systems*

The predictive aspects of the MMS study require that the existing cultural data be utilized in order to reconstruct the general distribution and patterning of contemporaneous human occupations (i.e., sites) over a landscape. Further, given the time range of interest to this study, it is appropriate to address potentially different patterns at different times during this period. A fundamental assumption in this process is that, when emergent, the now subtidal continental shelf areas offered environmental conditions similar to those reported for adjacent coastal terrestrial surfaces. As such, it is useful to consider what the available data indicate about coastal land use pattern in the study area. The following subsections present accounts of site types and distributions, Late Pleistocene/Early Holocene settlement and subsistence systems, and Late Prehistoric settlement and subsistence systems.

2.4.4.1 Site Types and Site Distributions

An initial approximation of the character of patterned relationships between a contemporaneous group of sites can be obtained by consideration of the types of sites involved and their distribution within the landscape. However, it should be clear from the preceding accounts of Oregon coast archaeology and culture history that the available data are marked by significant biases and other inherent limitations which restrict our view of these issues.

Biases and limitations in the existing Oregon coast database are particularly apparent with respect to site types. Detailed assessments of the character (and potentially the function) of individual sites can only be made with the findings of adequate sampling and, as relatively few sites have been sampled and most which have are represented by only small samples, such assessments are difficult. Similarly, site record data generated during surveys is invariably limited and offers only a very generalized basis for the construction of site typologies.

At least two functional site typologies have been proposed for portions of the Oregon coast, but neither is considered to be appropriate for use here. A distinction between "villages" and "camps" based upon site size, tool assemblage diversity, and the presence of house pits has been used on several parts of the coast (Minor and Toepel 1983; Minor et al. 1985; Minor 1986a). Recently, however, Lyman and Ross (1988:73) have shown that the employed criteria are seriously affected by sample size and, therefore, that assignments made on this basis are questionable. Draper (1988) has proposed a more detailed classification wherein functional categories of tool types, features, and related facilities are identified with the types of sites associated with Binford's (1980) collector type adaptation. This approach is also probably influenced by sample size; while potentially appropriate for adequately sampled sites, it should not be applied to sites described solely by site survey records.

Given the available data, and the biases inherent therein, this discussion of Oregon coast site types will rely upon a highly generalized typology based on the gross physical character of the dominant cultural materials involved. From this perspective, five general types of sites may be recognized: shell middens, lithic sites, burial grounds, rock art sites, and so-called "wet" sites. Among the known sites, shell middens are by far the most common, accounting for approximately 88 percent of all sites in the area. Lithic sites are the second-most common type, representing another approximately 8 percent. In contrast, the three remaining types are rare.

The term "shell midden" is here used only to indicate that a cultural deposit contains a significant fraction of marine shell. No specific functional connotation is implied and, given the overwhelming predominance of this type, it is likely that significant functional variation occurs among sites which contain marine shell refuse. In fact, the vast majority of all of the sites addressed in the functional typologies noted above are shell middens. Thus, the "lumping" of these sites into a single group should be seen as a recognition of the view that we cannot currently distinguish types among them, rather than as a suggestion that they all represent the same type of occupation.

Shell midden sites are well represented on all portions of the Oregon coast. They occur in a wide variety of local landscape settings and while some north to south variation is apparent, it is at least in part a reflection of local landscape variation over this same area. Present in a wide range of outer coast locations, shell middens on the northern and central Oregon coast exhibit a tendency to concentrate in bay, estuary, and river mouth settings; such settings are rare on the southern Oregon coast and in this area, shell middens atop coastal bluffs are much more common.

Lithic sites are sites marked by a predominance of chipped stone materials. While animal bones may be present, shellfish remains are either scarce or absent. As was the case with the shell middens, this group may also include some degree of functional variation. Compared to the shell middens, however, lithic sites are far less numerous and appear to reflect far less physical variation. Thus, more limited functional variation may be represented. Lithic sites also occur on all portions of the Oregon coast, but they are more common in southern Oregon and they exhibit somewhat more limited local landscape distributions. They are most common on older beach ridges, coastal bluffs, and lower river settings; lithic sites in bay, estuary, or outer coast settings are unusual. In one case (35TI55), chipped stone materials have been encountered in a shallow subtidal setting in Newhalem Bay, but whether they represent an inundated site or are simply re-deposited from a terrestrial source is unknown.

The three remaining site types on the Oregon coast are currently represented by such small samples of sites, and have been the focus of such limited direct study, that it is difficult to offer many generalizations about them. At least five sites are specifically identified as burials. Several were destroyed prior to actual site recording and virtually nothing is known about them. In some cases, such burial grounds may have been associated with nearby shell midden sites and, in this regard, it is worth noting that many Oregon coast shell middens are known to contain human burials even though they are not identified as burial grounds. At least two sites on the Oregon coast contain rock art in the form of petroglyphs; both are limited to a small number of geometric elements. Both examples are located near, and may be associated with, shell midden sites. Finally, there are at least four sites on the Oregon coast which contain "wet" deposits with well-preserved plant fiber artifacts. In three of the four cases, the preserved items are wooden stakes representing a fish weir located within a bay or lower river channel; presumably all are associated with nearby terrestrial sites.

2.4.4.2 Late Pleistocene/Early Holocene Settlement and Subsistence Systems

All of the data and discussion presented thus far should make it clear that there is only a very limited basis for speculations regarding the nature of Late Pleistocene/Early Holocene settlement and subsistence systems on the Oregon coast. Very few data are available and those which are occur within the context of competing models for the early prehistory of the entire Northwest Coast region. The maritime cultures of the Northwest Coast during the Late Holocene have been variously proposed to be derived from: (1) early interior cultures entering from the east, (2) early maritime cultures entering from the north, or (3) some combination of the former two. Taking the region as a whole, an increasing body of data suggests that the third alternative is most likely, but the specific nature of such cultural interactions and how they relate to the Oregon coast are unknown.

The review of the Paleo-Indian period presented above (see Section 2.4.2.1) indicated that there are possible indications of at least three early cultural traditions on or near the Oregon coast. Two of these, the FPT and the SPT probably date to the Late Pleistocene, although the latter may extend into the Early Holocene. Both of these early traditions are usually visualized as forager-type adaptations oriented predominantly toward terrestrial resources; their origins are considered to have been in the interior (Haynes 1980; Bryan 1980). If they were present and, if they actually influenced subsequent cultural developments here, they may be considered to be examples of model 1 noted above. The third early tradition potentially present on the Oregon coast, the PTT, is probably slightly more recent and may be of Early Holocene rather than Late Pleistocene age. More problematic than the former two, the PTT was first considered to also be an interior forager-type adaptation oriented toward terrestrial and riverine resources (Butler 1961). Recently, however, there have been increasing indications of the use of marine resources by representatives of this tradition (Matson 1976, 1988; Carlson 1979) and some researchers have suggested a coastal origin for it (Fladmark 1982; Carlson 1983, 1990). Depending on how you visualize it, the PTT could be considered an example of any of the models noted above.

Somewhat better, but still limited, data is available for Early Holocene materials directly addressed by the culture history units proposed in the Lyman and Ross (1988) chronology presented above. Before considering such data however, it is worth noting that the units in this chronology are "adaptational stages" (Lyman and Ross 1988:98) which explicitly embrace the "interior cultures from the east" model (model 1 above). Should subsequent findings indicate another source or sources for the Late Holocene Oregon coast cultures, at least some of the units in this chronological scheme will need to be reconsidered.

The Pre-Littoral stage is the only chronological unit which addresses the Early Holocene on the Oregon coast. As described by Lyman and Ross (1988:98), the representatives of this stage "...probably were generalist foragers, exploiting a broad range of resources available in coastal environments. A focus on riverine and upland resources may have been the major subsistence orientation." Elsewhere in this same account, they describe a riverine/interior adaptation which apparently represents the Pre-Littoral stage. They suggest that groups with this adaptation "...depend to some degree on riverine resources such as salmon....but have restricted (if any) access to the coast and sea" (Lyman and Ross 1988:96).

As noted during the earlier discussion of this chronological unit however, the few materials cited as possible representatives of this stage do not appear to be consistent with the adaptation they visualize. Central to this view is Component I from 35DO130 (Minor and Toepel 1986:104). During this period, the site was situated along an estuary, with the coastline located a kilometer or more to the west. Faunal remains associated with the component include marine fish (staghorn sculpin, tomcod, hake, and flatfish), birds (ducks, cormorants, shearwaters, murres, and gulls), and mammals (deer and harbor seal). This assemblage represents considerable use of marine resources and of particular significance are the tomcod, hake, shearwaters, and murres. These latter animals are most common in offshore settings and it is rather unlikely that they were all taken within the estuary immediately in front of the site. Thus, considerable estuarine activity and at least a possible limited presence in offshore coastal waters are implied, and such a range of maritime adaptations is clearly inconsistent with the characterization "Pre-Littoral". Unfortunately, no other subsistence data is available for this early period on the Oregon coast and therefore it is not possible to either reconstruct the complete annual subsistence base of the group represented by Component I or to evaluate how widespread or typical such Early Holocene maritime pursuits were. Nevertheless, significant maritime activities, including at least a limited presence in offshore coastal waters, were occurring at at least one location on the central Oregon coast by ca. 8,000 B.P.

In total then, only a few observations can be made about the probable nature of Late Pleistocene/Early Holocene settlement and subsistence systems on the Oregon coast. It is possible that the coast was occupied during the Late Pleistocene; an Early Holocene occupation is certain. It can safely be assumed that the earliest inhabitants of the coast utilized a range of terrestrial and riverine resources. What role marine resources may have played is less clear. A number of estuarine and offshore animals were being exploited by approximately 8,000 years ago, but uncertainty about the timing of the earliest arrivals obscures potential inferences regarding the relationship of this adaptation to the first occupants of the coast.

Theoretically, the earliest occupants of the Oregon coast could have been either collectors or foragers. In fact, Binford's (1980) original discussion of the forager-collector model includes the view that there was something of a lattitudinal dimension to the global distribution of these systems. Within this context, Binford (1980:15) argues that collector-type strategies are more likely to occur at higher lattitudes. Essentially this view has been expressed for the Northwest Coast by Aikens, Ames, and Sanger (1986). In contrast, however, most recent ideas about the early prehistory of this area visualize forager-type strategies (e.g., Borden 1975; Fladmark 1975; Schalk 1978; Thompson 1978; Carlson 1983). On the Oregon coast itself, the chronology proposed by Lyman and Ross (1988) assumes that earliest Pre-Littoral Stage occupants were foragers.

In reviewing the choices, it is worthwhile to consider their implications for the known archaeological record of the Oregon coast. While potential Late Pleistocene archaeological data are very limited, the few available traces (e.g., the fluted point from Sittcoos Lake (Minor 1985)) appear to be expressions of early cultural traditions which occurred widely in western North America, and are at least somewhat better known from other sites.

Land use reconstructions for such early cultural traditions as the FPT, SPT, and PTT invariably view these to have been foragers. If present in coastal areas, it seems reasonable to consider that representatives of any of these traditions would have incorporated marine resources as one or more elements of their foraging strategies. Thus, if these cultural traditions are, in fact, evidence of the earliest human inhabitants, then the first occupants of the Oregon coast probably were characterized by forager-type settlement and subsistence systems. Alternatively, if a collector-type system is visualized for the Late Pleistocene of the Oregon coast, it must be acknowledged that it would probably have been unrelated to any of the above-mentioned early traditions. Visualizing an early coastal-based collector-type adaptation therefore appears to imply the presence of yet another (currently unrecognized) early cultural tradition on the Northwest Coast.

At present, the interpretation that Late Pleistocene and Early Holocene occupations of the Oregon coast were probably by forager-type systems seems most plausible. As such, individual human groups were probably relatively small and they were marked by a high degree of residential mobility. Architecture and other aspects of material culture inventories were probably relatively limited. Since food-storage technologies were not employed to any significant degree, hunting, gathering, and other food-producing activities were conducted regularly throughout the year.

2.4.4.3 Late Prehistoric Settlement and Subsistence Systems

As compared to the Early and Mid Holocene, Late Prehistoric settlement and subsistence systems on the Oregon coast are much better documented, but significant uncertainties are apparent here as well. It is clear that the latest (i.e., ethnographic) systems were of the collector type. However, when and how such collector-type adaptations developed and what their relationships to the earlier forager- or collector-type adaptations may have been is largely unknown.

Data considered above indicates that forager-type systems, including the use of marine resources, were present as early as 8,000 years ago. Limited Mid-Holocene data suggest that this pattern continued with a broadening and intensification of the use of marine resources. Notable is an apparent increase in the use of marine shellfish between ca. 5,000 to 3,000 years ago. The so-called "bluff sites" may also date to this period, but their significance is unclear; while they may represent a separate interior-oriented settlement and subsistence system, this is undemonstrated. By this time, virtually the entire range of ethnographic resources were probably being utilized and the question becomes: when did use of these resources within a forager-type system shift to their use within a collector type system? In principle, this shift should be marked by such attributes as larger sites with evidence of substantial houses, evidence for food storage, evidence of mass harvesting, and a diversification of settlement types.

In the Lyman and Ross (1988) chronology, the second half of the Holocene is represented by the Early Littoral and Late Littoral stages. These two stages are seen as largely a continuum, with the shift from a forager-type system to a collector-type system being a principal distinction between them. Lyman and Ross (1988:100) see this shift as occurring gradually, with the establishment of the Late Littoral Stage and its collector strategy by ca. 1,500 to 2,000 years ago. It should be noted, however, that they cite no specific evidence in support of their view of the settlement and subsistence shift at this time. In fact, there is some evidence from the southern Oregon coast that this shift occurred somewhat earlier. For example, Cressman (1977) reports a semi-subterranean house at 35CU62 which has been radiocarbon dated to 3,000±90 B.P. While undated, Draper (1988:109) suggests that some of the houses excavated at nearby 35CU61 may be almost as old. Thus, while there is no reason to believe that a change in land use patterns occurred on all portions of the coast at the same time, there is some basis to consider that the shift to a collector-type system may have occurred prior to ca. 3,000 years ago in southern Oregon.

The settlement and subsistence pattern proposed for the Late Littoral stage is essentially that described for the ethnographic cultures of the Oregon coast. Lyman and Ross (1988:100), in fact, reference ethnographic data in describing it. In contrast to this view, Draper (1988) has suggested that the ethnographic settlement pattern was a response to protohistoric/early historic conditions, chief among them being a substantial reduction in population due to introduced diseases. While his analysis was restricted to southern Oregon, it is suggested here that his concepts are probably relevant to the entire coast. Basic elements of his late prehistoric settlement model include:

> "...(1) that prehistoric population densities were much higher than that suggested in the ethnographic literature; (2) that because of the resource base exploited prehistorically and the distribution of these resources across the landscape, the settlement pattern was essentially a linear one rather than a radial or planar one; (3) that residential mobility was low, characterized by numerous villages largely occupied year round by small family groupings perhaps confined to well defined territories; and (4) that because of the above elements, productive site locations (villages or temporary camps) that provided access to a wide array of resources were highly valued and thus repeatedly occupied and served multiple functions in the settlement system" (Draper 1988:269).

Testing of this model with data from southern Oregon coast sites indicates that it is a plausible explanation for the distribution and patterning of archaeological materials for most of the last 3,000 years. Interestingly, a very similar shift from more sedentary late prehistoric villages to the more mobile early historic land use pattern has also been proposed to the north, on the west coast of Vancouver Island (Inglis and Haggarty 1986). While there is considerable distance between these areas, and the shift has not been unequivocally demonstrated in either area, this suggestion appears more reasonable than the view that the arrival of the Europeans did not have an impact on native settlement patterns.

In summary, while the late prehistoric period of the Oregon coast is much better documented than earlier periods and some of the broad outlines of settlement and subsistence trends are clear, most of the specific details regarding the timing, nature, and dynamics of changes during this time remain uncertain. It is likely that a shift from an earlier forager-type system to a more logistically based collector-type system occurred during the second half of the Holocene, but just when or why this happened remains unclear. If the presence of semi-subterranean houses can be taken as a physical manifestation of the collector-type system, then such a land use pattern may have been in place in southern Oregon prior to ca. 3,000 years ago. While some researchers see the late prehistoric collector strategy as essentially that described in ethnographic accounts of this area, an alternative view suggests that substantially higher population densities during the last few millennia were associated with an adaptation marked by a linear settlement pattern, very low residential mobility, and frequent re-occupation of valued locations.

2.5 Columbia River Mouth

The Columbia River mouth portion of the study area is an arbitrarily defined zone intended to address the river mouth and nearby adjacent lands in both Oregon and Washington. It approximates, though is not exactly equivalent to, the ethnographic range of Lower Chinookan peoples. Specifically, it extends from Tillamook Head in Clatsop County, Oregon, to the vicinity of the town of Ocean Park in Pacific County, Washington. In the river mouth itself, the zone extends upstream to a boundary marked by Tongue Point on the Oregon side and the southeastern corner of Pacific County on the Washington side.

2.5.1 Previous Research

The lowermost portion of the Columbia River, and adjacent portions of the southern Washington and northern Oregon coasts, share much in common with other nearby coastal areas. Beyond environmental and cultural similarities, the history of archaeological research here also reflects regionwide patterns. Perhaps most notable in this regard is the general paucity of research data; the Columbia River mouth is probably among the least studied portions of the Oregon and Washington coasts.

Unlike coastal areas to the north and south, there were no late nineteenth- or early twentieth-century investigations of archaeological resources in the Columbia River mouth. Rather, the first systematic research activities in the vicinity of the river mouth occurred during the large-scale site survey activities conducted in the late 1940s and early 1950s. None was confined to the Columbia River mouth, however; they were broader coastal studies which extended into this area. (While these researchers sometimes probed into sites during survey, their findings were rarely described in detail and such activities are not considered to be formal excavations.) The first of these was Daugherty's survey of the outer coast of Washington in 1947. This survey recorded several sites on the Washington side of the river mouth and along the coast just to the north (Daugherty 1948). Robert Hudziack and Clarence Smith of the Smithsonian Institute also recorded a number of aboriginal settlements on the Washington side near the mouth of the Columbia River in 1948. On the Oregon side of the river, the first site survey efforts came as a part of Collins' (1953) examination of the northern and central Oregon coast in 1951. Out of the University of Oregon, Collins recorded 15 prehistoric sites in the vicinity of Astoria and on the Clatsop Plains just to the south of the river mouth (Collins 1953).

Following this period of activity, the intensity of site survey efforts in the Columbia River mouth declined considerably, but several subsequent studies have been conducted here. In the late 1950s, several additional sites were recorded on the Washington side by the University of Washington's Fort Columbia Project (Kidd 1960). Cultural resource management surveys began to occur in the area in the early 1970s (Rice 1974; Jermann and Hollenbeck 1976; Cole and Pettigrew 1976). In the late 1970s, the Lower Columbia River became the focus of a broadly based settlement and subsistence study by Rick Minor of the University of Oregon. Minor (1983) conducted considerable survey here, particularly on the Oregon side of the river; he added at least 12 sites to coastal areas in the vicinity of the river's mouth. Since Minor's work, archaeological survey efforts have been limited largely to cultural resource management efforts (Connolly 1987a, 1987b) and only a few additional sites have been recorded.

The excavation of prehistoric sites in the vicinity of the Columbia River mouth began in 1967 when Phebus and Drucker, two local amateur archaeologists, began to investigate two large shell midden sites located near Seaside on the southern end of the Clatsop Plain (Phebus and Drucker 1973, 1979). Both sites, 35CLT20 (the Par-Tee Site) and 35CLT47 (the Palmrose Site), are situated on old dune ridges near the mouth of the Necanicum River. Excavations at these sites continued for more than 10 years, during which time a third shell midden site, 35CLT13 (the Avenue Q Site) (Figure III-10), was also briefly investigated. Radiocarbon dates and artifacts suggest that all three are late prehistoric in age. Given the duration of their effort, Phebus and Drucker were able to collect a substantial sample from the former two; the combined sample from 35CLT20 and 35CLT47 includes at least 9,423 artifacts and more than 113,000 pieces of associated faunal materials. Unfortunately, however, a detailed account of these sites is yet to appear.

Between 1971 and 1974, Fred Hasle of Clatsop Community College directed test excavations of another shell midden site on the Clatsop Plain. This site, 35CLT27, is also situated on an old dune ridge. While the recovered collection and other details of this project have never been described, published radiocarbon dates (Sheppard and Chatters 1976:145) indicate that it is also late prehistoric in age.

Minor's (1983) study of settlement and subsistence on the lower Columbia River also included a program of test excavation of sites located in coastal, estuarine, riverine, and interior settings near the river's mouth. In total, Minor tested six sites, one of which was located along the coast. 45PC35 (the Fishing Rocks Site) is located just north of the mouth of the river on the northwest side of Cape Disappointment. It is situated in a small rocky cove, at the toe of a steep bluff. Excavations here produced a modest sample of artifacts (208 items) and associated faunal materials. Radiocarbon dates and artifacts indicate that the site contains both late prehistoric and early historic deposits.

There appear to have been only very limited site testing efforts in this area since the completion of Minor's study. All such investigations have addressed sites on the Clatsop Plain south of the river's mouth and all have been conducted within the context of cultural resource management investigations by Thomas Connolly of the Oregon State Museum of Anthropology. They have included limited soil auger probing at 35CLT66, a shell midden deposit buried under a stabilized sand dune north of Gearhart (Connolly 1987c), and additional testing at 35CLT13 and 35CLT47, shell midden sites previously examined by Phebus and Drucker (Connolly 1988).

In total, archaeological research activities in the Columbia River mouth area have produced a limited body of data which parallels the broader regional database in a variety of ways. Within the area defined by this study, 34 prehistoric archaeological sites have been recorded; this includes 26 sites from the Oregon side of the river and eight sites from the Washington side of the river. Of these, a total of five have been the subject of at least limited excavations; four on the Oregon side and one on the Washington side. Due to the relative recency of these efforts, all of them have been dated by at least one assay. With respect to their geographic distribution within this area, it is already apparent that nearly all of the available data representing excavated sites comes from the south side of the Columbia River. A further observation in this regard is that, of the six excavated sites, none are actually located along the shores of the river; all are located along or near ocean beaches not far from the mouth of the river. Although a number of these

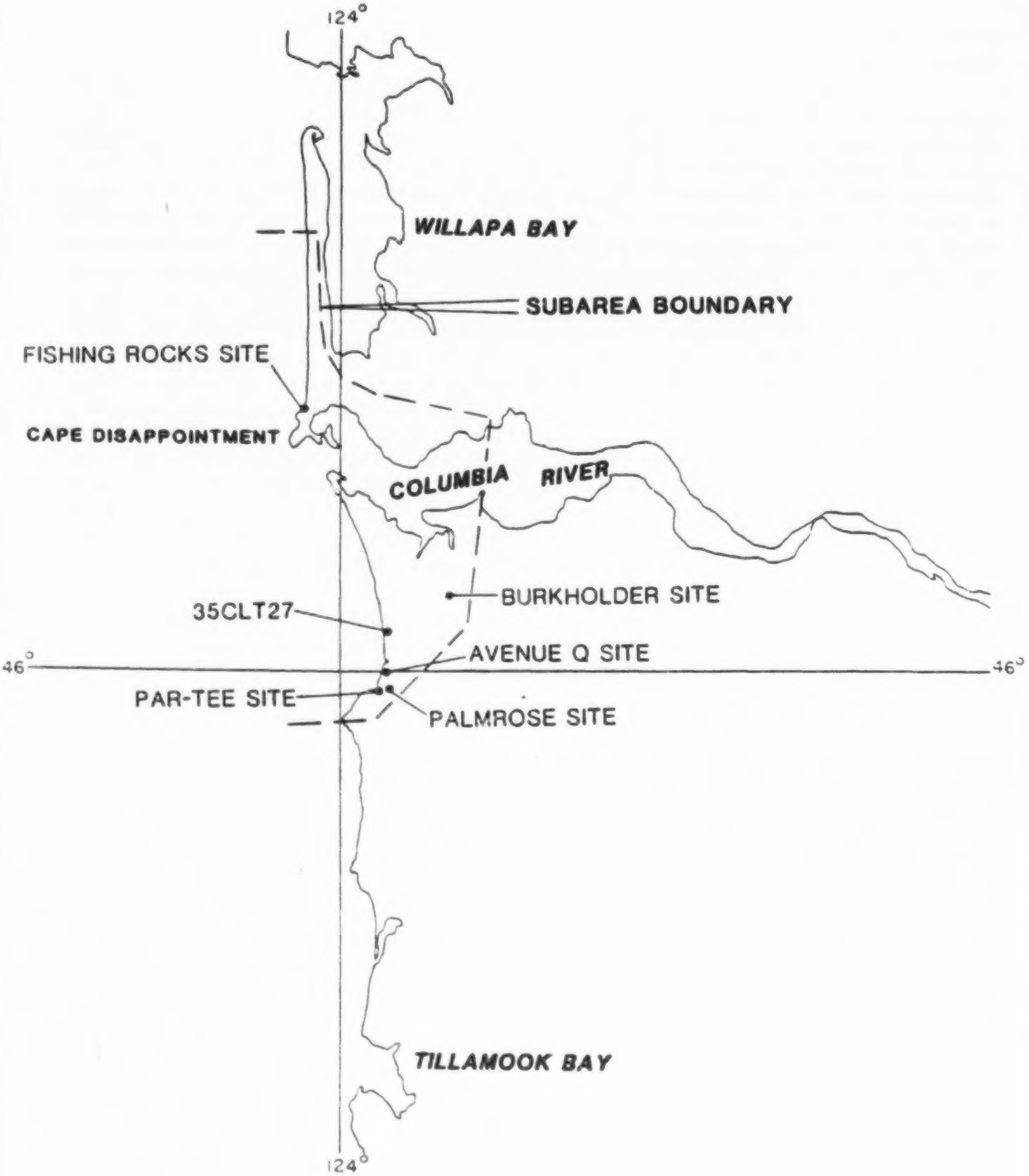
124°
WILLAPA BAY
SUBAREA BOUNDARY
FISHING ROCKS SITE
CAPE DISAPPOINTMENT
COLUMBIA RIVER
BURKHOLDER SITE
35CLT27
AVENUE Q SITE
46°
46°
PAR-TEE SITE
PALMROSE SITE
TILLAMOOK BAY
124°

Figure III-10. Archaeological Sites Mentioned in the Text for the Columbia River Mouth.

excavations and related analyses have yet to be reported in detail, at least limited accounts are available for most of these efforts.

Consistent with the rest of the region, biases and other inherent limitations also impose important restrictions on the value of much of this data. For the most part, these conditions closely parallel those noted for the Oregon coast. Most notably, all of the sampled sites appear to represent relatively recent occupations and all are shell midden deposits. While apparently older sites and non-shell cultural deposits do occur here, none have been subject to controlled excavations. Additionally, all of the analytical problems identified by Lyman and Ross (1988) for the Oregon coast (i.e., implicit or non-existent research designs, small artifact sample sizes, incomplete and inaccurate reporting of data, and ambiguous use of analytical and conceptual terms) are, to varying degrees, true here as well. These latter conditions are particularly vexing in that the extensively examined sites (35CLT20 and 35CLT47) are among the most poorly reported ones.

2.5.2 *Culture History*

In view of the limited nature of archaeological research in the Columbia River mouth, it is not at all surprising that its culture history is only very broadly known. As such, discussion here will utilize the basic approach as presented above: the account will review local cultural-historical units with reference to the statewide temporal scheme recently developed in Oregon (Gilsen 1989), and it will consider archaeological materials from other nearby regions when they offer potential insights into Columbia River mouth prehistory. Cultural-historical reconstructions for the Columbia River mouth are based upon a very small sample of excavated sites, but all of this work has been relatively recent, and all of it can be accommodated by the only cultural chronology yet proposed for the area (Minor 1983). In fact, Lyman and Ross's (1988) chronology for the Oregon coast (presented above) also addresses the southern half of the Columbia River mouth, but since Minor's is more specific to this area, it will be utilized as the basis of this account.

2.5.2.1 Youngs River Complex

The earliest cultural-historical unit recognized in Minor's (1983) chronology is the Youngs River Complex. This unit is defined largely on the basis of a surface collection of 184 objects from 35CLT31 (the Burkholder Site) located near the Youngs River in northwestern Oregon, approximately 10 km inland from the Pacific Ocean (Minor 1984). A few other isolated surface finds from this same general area are also considered a part of the complex. The collection from 35CLT31 includes several styles of chipped stone projectile points, knives, scrapers, utilized flakes, and cobble tools. Two baked clay "sinkers" were also collected here. Potentially diagnostic specimens are limited largely to the projectile points and, while apparently ancient, these objects may represent more than one early tradition (hence, Minor's appropriately cautious characterization of this collection as a "Complex" rather than a "Phase"). Specifically, the collection includes relatively large-stemmed forms potentially representative of the SPT and leaf-shaped forms potentially representative of the Pebble Tool tradition. While both may be present, the case for the former currently appears stronger. On the basis of these similarities, Minor suggests an age between ca. 10,000 and 6,000 B.P.

Minor (1983, 1984) visualizes the Youngs River complex as representing an early prehistoric culture with a generalized adaptation focused primarily on terrestrial and riverine resources. This assumed orientation is much like Lyman and Ross' (1988) Pre-Littoral stage unit for the Oregon coast, although many specific details of the assemblages differ. In much the same sense, it is at least broadly similar to Bergland's (1983) Early Prehistoric period for the northern Washington coast. It could be suggested that the Youngs River complex is probably older than the

Pre-Littoral stage and more closely contemporaneous with the Early Prehistoric period, but as the actual temporal ranges of none of these are known, this is simply speculation. Depending upon which early tradition, or traditions, you think are represented by the Youngs River complex, it could be considered a representative of the Oregon statewide Paleo-Indian period, the Early Archaic period, or both.

2.5.2.2 Seal Island Phase

The Seal Island phase is the second cultural-historical unit in Minor's (1983) chronology. It is the oldest widely represented assemblage from the vicinity of the Columbia River mouth for which good radiometric dates are available. Seal Island phase materials clearly represent a culture adapted to a wide range of terrestrial, riverine, and marine resources. Assemblages assignable to this phase occur in non-shell cultural deposits in both riverside and interior locations as much as 40 km up the Columbia River and in coastal shell midden sites on the Clatsop Plain south of the river's mouth. In at least one site, 35CLT47, they are associated with a semi-subterranean house pit thought to represent a structure much like an historic period Chinookan style cedar-plank longhouse (Phebus and Drucker 1979). Seal Island phase assemblages contain chipped stone projectile points, unifacial scrapers, utilized flakes, cobble tools, abrader/whetstones, girdled netstones, atlatl weights, and bone unipoints, bipoints, wedges, and a variety of harpoons including unilaterally barbed, bilaterally barbed, and composite toggling forms. Broad-necked projectile points with either stemmed or corner-notched bases are considered the most diagnostic artifacts for this phase. Minor (1983) places the Seal Island phase between ca. 6,000 and 2,000 B.P.

Unlike the preceding Youngs River complex, the Seal Island phase is clearly related to a number of other nearby regional prehistoric assemblages. The closest analog to it appears to be the Marybell phase, an at least partially contemporaneous assemblage from the Portland Basin of the Lower Columbia River Valley (Pettigrew 1981). The similarity between these two is so strong, in fact, that there is little to distinguish them other than geographic extent. (Given that Minor (1983) suggests a significantly earlier date for the appearance of the Seal Island phase, one could propose that the Marybell phase represents an upriver extension of the former. Such a conclusion, however, must be constrained by the fact that his oldest radiocarbon dates for the phase are only slightly more than 3,000 B.P.). The Seal Island phase also shares many common attributes with Ross's (n.d.) Early Littoral stage for the Oregon coast. While it is likely that Seal Island phase assemblages also occur on the southern Washington coast, there is remarkably little data from that area and cultural-historical units have yet to be proposed there. Bergland's (1983) northern Washington coast chronology does not contain an equivalent unit. In terms of Oregon's statewide temporal scheme, the Seal Island phase is a representative of the Middle Archaic period.

2.5.2.3 Ilwaco Phase

The final prehistoric unit in Minor's (1983) chronology is the Ilwaco phase, which is subdivided into the Ilwaco 1 and Ilwaco 2 subphases. The Ilwaco phase appears to be a direct development out of the preceding Seal Island phase, and the two share many features. Differences between these two, as well as the differences between the Ilwaco subphases, address changes in the occurrence of certain artifact styles. The principal distinction between the Seal Island and Ilwaco phase assemblages is a shift from relatively larger broad-neck projectile points (assumed to represent atlatls) to relatively smaller narrow-necked projectile points (assumed to represent bows and arrows). The earlier Ilwaco 1 subphase is dominated by small narrow-necked, triangular, stemmed points, although the larger broad-necked forms and atlatl weights are still present. In the subsequent Ilwaco 2 subphase, only the small narrow-necked forms are present. The Ilwaco phase dates between ca. 2,000 and 200 B.P., the break between the subphases occurring ca. 1,000 years B.P.

The Ilwaco phase is also clearly related to a number of other nearby regional prehistoric assemblages, and these relationships closely parallel those noted for the preceding Seal Island phase. The closest analog again appears to be from the Portland Basin of the Lower Columbia River Valley, in this case with Pettigrew's (1981) Multnomah phase. The latter is divided into three subphases, the first two of which are prehistoric and closely approximate the Ilwaco subdivisions in both content and temporal extent. The Ilwaco phase is also much like Ross's (1990) Late Littoral stage for the Oregon coast, particularly so with northern coast expressions of it. To the north, this parallel is also apparent. Ilwaco phase assemblages undoubtedly occur over at least some portion of the southern Washington coast, but data sufficient to propose a cultural chronology are not yet available. Still further north, Bergland's (1983) northern Washington coast chronology does not contain an equivalent unit. In terms of Oregon's statewide temporal scheme, the Ilwaco phase is a representative of the Late Archaic period.

2.5.3 Ethnography

It is clear that the Ilwaco phase of the Columbia River mouth represents late prehistoric Chinookan culture. Perhaps the strongest statement in support of this view is the last unit in Minor's (1983) chronology, referred to as the Ethnographic phase. It is essentially ethnographic Chinookan culture. From an archaeological point of view, it is essentially a slight variation on the Ilwaco phase, plus the addition of historic materials. Exclusive of the historic materials, distinctions between the Ethnographic phase and the Ilwaco phase are limited largely to slightly greater variety in the styles of small narrow-necked projectile points and a shift from the earlier girdled netsinkers to perforated and wrap-marked netsinkers.

The ethnographic peoples of the Columbia River mouth (Figure III-11) represent a single major language group: Penutian (Thompson 1973:994). More specifically, they all spoke dialects of a single Penutian language generally referred to as Lower Chinook (Boas 1894). Within the area of concern here, these peoples are readily divisible into two more local groups who spoke very similar dialects of the Lower Chinook language: the Clatsop and the Chinook. The latter are sometimes referred to as the "Chinook proper" (Minor 1983) in order to distinguish them from the more generalized use of the term "Chinook" as a reference to all of the Chinookan groups of the Columbia River. With their very strategic location at the mouth of the largest river in the region, the Lower Chinook speakers were among the first Northwest Coast peoples to have contact with Europeans, and among the first to be decimated by that contact. As a direct consequence, we know relatively little about them. Estimates of early Contact period populations prepared by Mooney (Kroeber 1939:136) suggest that Columbia River Chinook peoples, in total, may have represented as many as 22,000 individuals. More recently, Taylor (1963:164-165) has dismissed this figure as far too high, and suggested a range of approximately 5,000 individuals. The Lower Chinook speakers presumably accounted for some percentage less than half this total. However, given that introduced diseases may have reached this area from California slightly prior to this time (Boyd 1985), a significantly larger late prehistoric population may have been present.

While neither of the Columbia River mouth groups have been extensively described in the available ethnographic literature, some of their basic characteristics have been recorded.

2.5.3.1 Clatsop

Language: As noted above, the Clatsop spoke a dialect of the Lower Chinook language, a member of the Penutian language group.

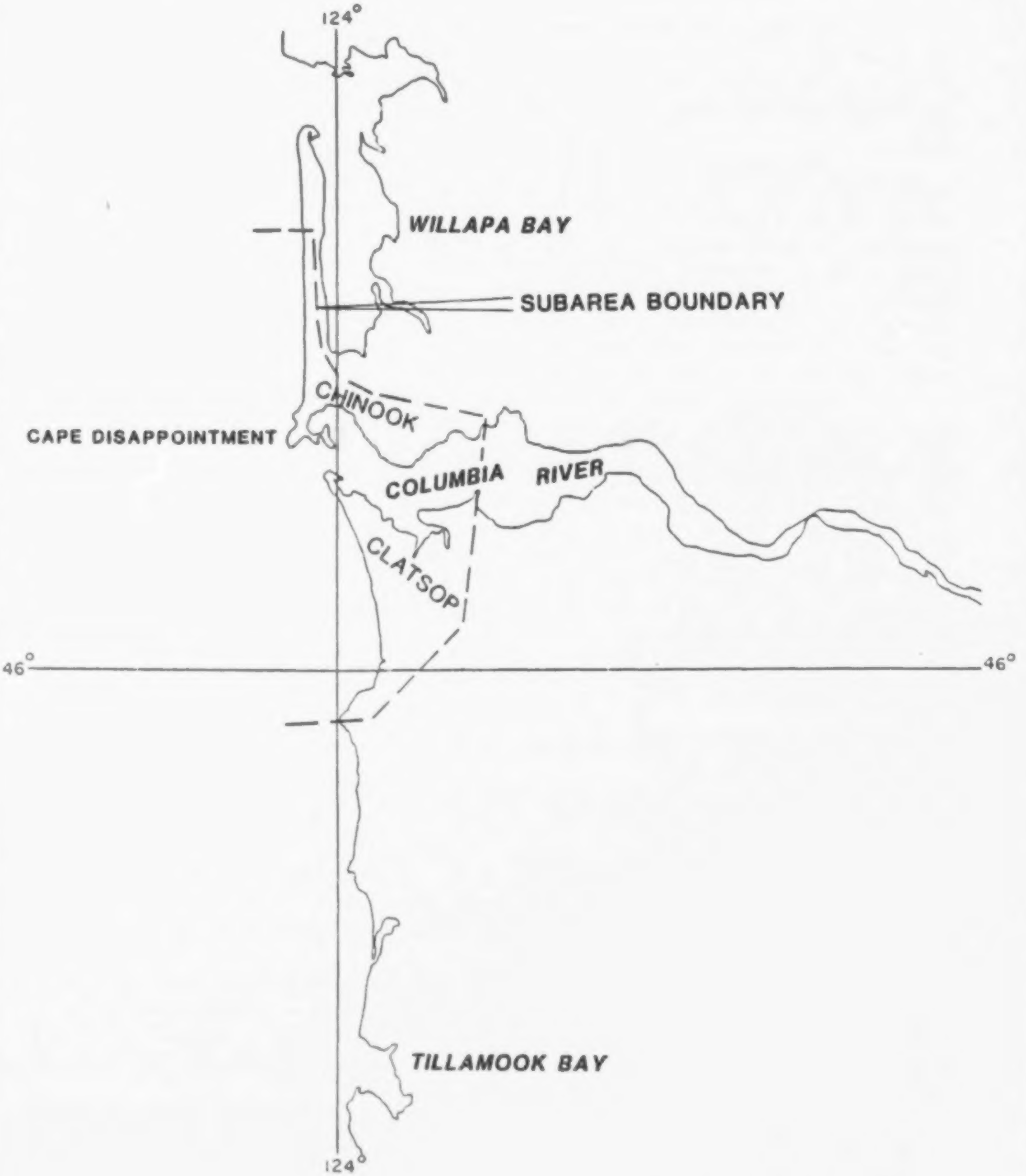
124°
WILLAPA BAY
SUBAREA BOUNDARY
CHINOOK
CAPE DISAPPOINTMENT
COLUMBIA RIVER
CLATSOP
46°
46°
TILLAMOOK BAY
124°

Figure III-11. Ethnographic Groups of the Columbia River Mouth.

Territory: The Clatsop people occupied the extreme northwestern tip of Oregon in the vicinity of the south side of the Columbia River mouth (Swanton 1952:61). Within the mouth of the river, they held the river's shore from Clatsop Spit east to the vicinity of Tounge Point. On the Oregon coast, they ranged over the entire Clatsop plain from Clatsop Spit south to Tillamook head.

Subsistence: The Clatsop subsistence basis relied principally upon fish, although a wide range of other marine and terrestrial resources were also important to them. By all accounts, salmon was the paramount food fish, but steelhead, sturgeon, herring, and smelt were also important. Terrestrial hunting also appears to have been important, with deer, elk, bear, and a variety of smaller mammals being taken frequently. Marine shellfish and marine mammals were significant resources as well; among the latter, the nearshore harbor seal was much more significant than any of the pelagic species. Plant foods eaten by the Clatsop included a range of roots, berries, and shoots. In contrast to their Washington coast neighbors, Ray (1938:123) suggests that acorns were "fairly extensively used" by the Clatsop.

Settlement: In some contrast to most of their northern neighbors, the Clatsop moved seasonally between "winter" and "summer" villages, both of which were apparently relatively large stable communities (Minor 1983). Smaller seasonal resource-oriented camps were also used, but may have been utilized for only a small part of the annual cycle. The principal structure of the village was a large split-cedar plank building which housed an extended family. The structure was vertically planked with a gable roof. Again in contrast to most Washington groups, a large rectangular pit was dug into the center of the house floor. Villages were invariably situated near water. Winter villages were located along the Clatsop Plain and on the lower reaches of small rivers which enter the Columbia River mouth. Summer villages were located along the shores of the Columbia River mouth itself.

2.5.3.2 Chinook

Language: The Chinook spoke a dialect of the Lower Chinook language, a member of the Penutian language group.

Territory: The Chinook people occupied the extreme southwestern tip of Washington in the vicinity of the north side of the Columbia River mouth (Swanton 1952:20-21). Very early in the historic period, the Chinook apparently occupied much of the Willapa Bay country as well, but they were subsequently replaced here by Lower Chehalis people. Within the mouth of the river, they held the river's shore from Cape Disappointment to the vicinity of Grays Bay. On the outer coast itself, they ranged over much of the North Beach Peninsula and may have extended as far as Grayland, Washington, at one time.

Subsistence: Chinook subsistence patterns were broadly based, and very much like those described above for the Clatsop. In fact, differences in resource emphasis between these two groups are difficult to discern. Some early accounts of them appear to suggest that terrestrial mammals may have been relatively less important to the Chinook, but quantitative data supporting this impression do not exist.

Settlement: Similar to subsistence, Chinook settlement patterns closely parallel those noted above for the Clatsop; they were strongly biseasonal, moving between relatively stable "winter" and "summer" villages. Chinook houses were architecturally indistinguishable from Clatsop houses, and were invariably situated in villages located near water. Winter villages were located along the shores of Willapa Bay and on the lower reaches of small rivers which enter the bay. Summer villages were located along the shores of the Columbia River mouth itself.

2.5.4 *Settlement and Subsistence Systems*

The predictive aspects of the MMS study require that the existing cultural data be utilized in order to reconstruct the general distribution and patterning of contemporaneous human occupations (i.e., sites) over a landscape. Further, given the time range of interest to this study, it is appropriate to address potentially different patterns at different times during this period. A fundamental assumption in this process is that, when emergent, the now subtidal continental shelf areas offered environmental conditions similar to those reported for adjacent coastal terrestrial surfaces. As such, it is useful to consider what the available data indicate about coastal land use patterns in the study area. The following subsections present accounts of site types and distributions, Late Pleistocene/Early Holocene settlement and subsistence systems, and Late Prehistoric settlement and subsistence systems.

2.5.4.1 Site Types and Site Distributions

An initial approximation of the character of patterned relationships between a group of contemporaneous sites can be obtained by consideration of the types of sites involved and their distribution within the landscape. As was the case with the preceding review of Oregon coast archaeology and culture history, however, the available data for the Columbia River mouth are marked by significant biases and other inherent limitations which restrict our view of these issues.

As noted, biases and limitations in the existing Columbia River mouth database are essentially equivalent to those which mark the Oregon coast data, and they are particularly apparent with respect to site types. Detailed assessments of the character (and potentially the function) of individual sites can only be made with the findings of adequate sampling and, as relatively few sites have been sampled and most which have are represented by only small samples, such assessments are often difficult. Similarly, site record data generated during surveys are invariably limited and offers only a very generalized basis for the construction of site typologies.

Only a single functional site typology has been proposed for the Columbia River mouth. This typology, offered by Minor (1983), is essentially a variation of that utilized by him on the Oregon coast (e.g., Minor and Toepel 1983; Minor et al. 1985; Minor 1986b). It is based upon a distinction between "villages" and "camps" and, in this case, two varieties of each type are recognized (i.e., winter villages, summer villages, shellfish gathering camps, and hunting/fishing camps). Diagnostic criteria include site size, the presence of house pits, tool assemblage diversity, the presence of seasonal fauna, and geographic location of the site (Minor 1983:81). Here again, however, the Lyman and Ross (1988:73) observation that many of the employed criteria are seriously affected by sample size is relevant, and therefore assignments made on this basis are questionable. It should further be noted that many of Minor's functional type assignments for Columbia River mouth sites utilize ethnographic and early historic documents and, to this degree, they are not actually based on any archaeological criteria.

Given the available data, this discussion of Columbia River mouth site types will rely upon a highly generalized typology based on the gross physical character of the dominant cultural materials involved. From this perspective, only three general types of sites may be recognized: shell middens, lithic sites, and burial grounds. (As used here, all three of these types are directly equivalent to those noted for the Oregon coast; see Section 2.4.4.1). Among these types, nearly all (approximately 94 percent) of the sites are shell middens. Lithic sites and burial grounds are currently represented by only a single example of each type.

The term "shell midden" is here used only to indicate that a cultural deposit contains a significant fraction of marine shell. No specific functional connotation is implied and, given the overwhelming predominance of this type, there can be no doubt that significant functional variation occurs among sites which contain marine shell refuse. In fact, both of Minor's villages and his shellfish gathering camps noted above are shell middens. Thus, the "lumping" of these sites into a single group should be seen as a recognition of the view that we cannot currently distinguish types among them, rather than as a suggestion that they all represent the same type of occupation. Shell midden sites are present in the mouth of the Columbia River and along outer coast areas to the north and the south. While occurring in a relatively wide range of local settings, they are most numerous along outer coast beaches and stabilized dune ridges backing these beaches. Shell middens within the Columbia River mouth itself are somewhat less common.

Examples of lithic sites and burial grounds are so limited within this area that it is difficult to offer many observations about them. Only a single lithic site (35CLT10) has been reported here. This site appears to be a cache of flaked cobbles and it is uncertain as to whether it is even properly considered to be a settlement. (Additional lithic sites which are more clearly settlements are known from interior settings not far from the Columbia River mouth.) Given the available sample, questions of possible functional variation among lithic sites cannot be addressed. Sites specifically identified as "burials" are equally uncommon, and represent a situation much like that noted for the Oregon coast. The single site (45PC1) was largely destroyed prior to actual recording and little is known about it. It is suggested to have been associated with a Chinook summer village (i.e., shell midden site), but it also no longer exists and therefore this claim cannot be evaluated. Consistent with nearby areas, it should be stressed that at least some Columbia River mouth shell midden sites are also known to contain human burials even though they are not identified as burial grounds.

2.5.4.2 Late Pleistocene/Early Holocene Settlement and Subsistence Systems

Data and discussion presented thus far should make it clear that there is only a very limited and indirect basis for speculations regarding the nature of possible Late Pleistocene/ Early Holocene settlement and subsistence systems in the Columbia River mouth. Very few data are available and those which are occur within the context of competing models for the early prehistory of the entire Northwest Coast region. The maritime cultures of the Northwest Coast during the Late Holocene have been variously proposed to be derived from: (1) early interior cultures entering from the east, (2) early maritime cultures entering from the north, or (3) some combination of the former two. Taking the region as a whole, an increasing body of data suggests that the third alternative is most likely, but the specific nature of such cultural interactions and how they relate to the Columbia River mouth are unknown.

The Youngs River complex described above (see Section 2.5.2.1) is the only currently known potential evidence for a Late Pleistocene or Early Holocene cultural presence in the vicinity of the Columbia River mouth. Unfortunately, however, little is known about the significance of these materials. As described by Minor (1984), this complex may contain evidence of one or two early cultural traditions: the SPT and the PTT. The former is generally considered to be of Late Pleistocene to Early Holocene age and is visualized as an interior forager-type adaptation oriented predominantly toward terrestrial and riverine resources (Rice 1972; Bryan 1980). If bearers of this tradition were present and, if they actually influenced subsequent cultural developments here, they may be considered to be examples of model 1 noted above. The second tradition potentially represented in the Youngs River complex is probably slightly more recent and is unlikely to date to the Late Pleistocene. More problematic than the former, the PTT was first considered to also be an interior forager-type adaptation oriented toward terrestrial and riverine resources (Butler 1961). Recently, however, there have been increasing indications of the use of marine resources by representatives of this tradition (Matson 1976, 1988; C. Carlson 1979) and some researchers have suggested a coastal origin for it (Fladmark 1982; Carlson 1983, 1990). Depending on how you visualize it, the PTT could be considered an example of any of the models noted above.

Given this limited database, very few observations can be made about the nature of possible Late Pleistocene/Early Holocene settlement and subsistence systems in the Columbia River mouth. It is likely that this area was occupied during the Late Pleistocene and Early Holocene, but unequivocal demonstration of this has yet to occur. It can safely be assumed that the earliest inhabitants of the Columbia River mouth (whenever they arrived) utilized a range of terrestrial and riverine resources. What role marine resources may have played is unknown. Regardless of the extent to which marine resources were used, however, it is likely that Late Pleistocene and/or Early Holocene cultures were characterized by forager-type settlement and subsistence systems. A collector-type system is not considered likely. (Note that perceptions of the Late Pleistocene and/or Early Holocene cultures of the Columbia River mouth are much like, and closely tied to, those for the early prehistory of the Oregon and Washington coasts. Indeed, possible expressions of all of the above-mentioned early cultural traditions occur widely in both states.)

Much like those already noted for the Oregon coast, Late Pleistocene and Early Holocene occupations of the Columbia River mouth were probably relatively small human groups marked by a high degree of residential mobility. Architecture and other aspects of their material culture inventories were probably relatively limited. Since food-storage technologies were not employed to any significant degree, hunting, gathering, and other food-producing activities were conducted regularly throughout the year.

2.5.4.3 Late Prehistoric Settlement and Subsistence Systems

Virtually all of the available settlement and subsistence data from the Columbia River mouth represent the Late Holocene, but significant uncertainties are apparent here as well. It is clear that the latest (i.e., ethnographic) systems were of the collector-type. However, when and how such collector-type adaptations developed and what their relationships to the earlier forager-type adaptations may have been are largely unknown. In principle, this shift from foraging to collecting should be marked by such attributes as larger sites with substantial houses, food storage, mass harvesting, and a diversification of settlement types. Actual evaluation of the timing and dynamics of the shift, however, is difficult because at this time, there are no data representing cultural activities at the Columbia River mouth between the above-noted probable Late Pleistocene/Early Holocene Youngs River complex and Seal Island phase occupations dating to ca. 2,000 to 3,000 years ago.

While descriptive details of Seal Island phase components are generally limited, they are described as a collector-type system already in place. Seal Island phase components dated as early as ca. 3,100 B.P. on the lower Columbia River appear to include relatively large stable settlements; associated artifacts and faunal remains indicate that a wide range of terrestrial, riverine, and marine resources were being utilized. In discussion of these materials, Minor (1983:129) equates them with ethnographic Lower Chinook land use patterns. Further, an occupation on the outer coast attributable to this phase contains evidence of a semi-subterranean house which has been radiocarbon dated to 2,565+/-70 B.P. (Phebus and Drucker 1979). Overall, these findings are consistent with the suggestion that a collector-type settlement and subsistence system was present at the Columbia River mouth as early as ca. 2,500 to 3,000 years ago and therefore the shift from foraging to collecting must have occurred prior to this time.

Given the equation of Seal Island phase settlement and subsistence practices with the ethnographic land use pattern, it is not surprising that the following late prehistoric Ilwaco phase is also considered in these same terms. As described, the Ilwaco Phase is clearly late prehistoric Chinookan Culture and it differs only slightly from the ethnographic period. Thus, aside from stylistic and/or technological changes in artifact forms, Minor (1983:210) suggests that there have been no substantial changes in the nature of aboriginal lifeways over the last 3,000 years. Except for the timing of the shift to collecting, this view of the recent prehistory of the Columbia River mouth is generally consistent with the Oregon coast culture history offered by Lyman and Ross (1988) wherein the Late Littoral stage is seen as essentially equivalent to the ethnographic cultures of that area. This interpretation implies that there were no protohistoric/early historic settlement changes analogous to those proposed by Draper (1988) for the southern Oregon coast. In light of the relatively early, and nearly total, historic decimation of Lower Chinook peoples, the absence of any sort of adjustment or dislocation in their land use system appears remarkable.

In summary, the relatively recent late prehistoric data from the Columbia River mouth appears to reflect a collector-type settlement and subsistence system already in place by ca. 2,500 to 3,000 B.P., and as such provides few insights into the specific details of the appearance of the land use strategy. While the known manifestations may, in fact, represent the first appearance of a logistically based collector-type system, the lack of older Late or Middle Holocene data makes this interpretation problematic. The current view of these materials suggests that a settlement and subsistence system essentially equivalent to that utilized by the ethnographic Lower Chinook people has characterized the Columbia River mouth for at least the last three millennia.

2.6 Washington

The Washington portion of the study area is a long narrow strip which includes all but the southernmost portion of the outer coast of the State of Washington. Specifically, it extends from the vicinity of the town of Ocean Park in Pacific County northward to Cape Flattery at the northwestern tip of the Olympic Peninsula, and then eastward down the southern shore of the Strait of Juan de Fuca to a point even with the northeastern corner of the Makah Indian Reservation. That portion of the outer coast south of Ocean Park is considered in the discussion of the Columbia River mouth. Included for consideration of this coastal zone are all sites located in the immediate vicinity of the outer coast, as well as those located along major bays and/or estuaries which mark it.

2.6.1 Previous Research

The outer coast of Washington is a rugged, wild, and largely undeveloped area. Much of it cannot be reached by road and it has been the subject of only limited archaeological research. As such, little about its prehistory is currently known.

The first archaeological research to be undertaken anywhere on the Washington coast was that conducted by Albert B. Reagan, the Agent at the Quileute Indian Reservation between 1905 and 1909. Working on his own, Reagan (1917, 1928) noted numerous shell midden sites along the coast between the Queets River and the Strait of Juan de Fuca and briefly examined and described the contents of many of them. He provided significant descriptive information about the middens and proposed a generalized chronological scheme for them based upon their contents and landform associations. While recognizing middens as being "recent, old, very old, and ancient" (Reagan 1917:18), he offered no estimations regarding the actual antiquities involved. No further archaeological efforts were conducted here for the next 30 years.

The era of modern archaeological field work on the Washington coast began with a number of relative large-scale site survey efforts. (While these researchers sometimes probed into sites during survey, their findings were rarely described in detail and such activities are not considered to be formal excavations.) The first of these was in 1947 when Richard Daugherty, then a student at the University of Washington, undertook a systematic survey of the entire outer coast of Washington. Daugherty (1948) recorded several dozen sites during this study. The following year, Robert Hudziak and Clarence Smith with the Smithsonian Institute's River Basin Surveys Program recorded the locations of 16 native American settlements on the southern

Washington coast. In 1956, Bruce Stallard and Clayton Denman, then students at the University of Washington, surveyed the Olympic coast between the Queets River and the Ozette River. They visited many of the sites reported by Daugherty and recorded several more. These studies recorded the majority of the currently known prehistoric site inventory for this region.

All subsequent archaeological survey and site-recording activities on the Washington coast have occurred within the context of much smaller efforts. Many have been associated with relatively recent cultural resource management studies and have confined their focus to small project areas. On the northern Washington coast, such studies include work by Maas (1980), Stilson (1987), and Wessen (1978, 1988b, 1989). On the southern Washington coast, similar efforts have been conducted by Brown (1976), Munsell (1976, 1980), Bensen (1979), Robinson (1982), and Daugherty (1982).

The excavation of prehistoric sites on the Washington coast began in 1957, when James Alexander of the University of Washington tested two sites on Willapa Bay: 45PC7 (the Martin Site) and 45PC9. Two years later, the University of Washington's Fort Columbia Archaeological Project conducted additional testing at the Martin Site (Kidd 1960, 1967). At about this time, researchers from Washington State University also became active. Under Daugherty's supervision, Thomas S. Newman (1959) undertook test excavations at 45JE9 (the Toleak Point Site) on the coast south of La Push, and Stanley Guinn (1962, 1963) did similar testing at 45CA30 (the White Rock Village Site) near Cape Alava. The latter two are located on exposed outer coast beaches, in sharp contrast to protected bay locations represented by the previous sites (Figure III-12). All such efforts resulted in the recovery of small samples of stone and bone artifacts (generally less than a few hundred items) and faunal materials from late prehistoric to early historic shell midden deposits.

In 1966, Daugherty began two seasons of extensive test excavations at 45CA24 (the Ozette Village Site), a very large shell midden site at Cape Alava. This interdisciplinary effort investigated several portions of the site area and provided the basis for subsequent excavations at Ozette (Kirk and Daugherty 1974). While cultural materials recovered here were much like those from the previously sampled sites, the Ozette collection was far larger (ca. 2,000 items) and was studied in greater detail (Gustafson 1968; McKenzie 1974).

Archaeological excavations were conducted at 45GH15 (the Minard Site) in 1969 and 1970 by Daugherty and Roll of Washington State University. Minard is a shell midden located on the protected side of the barrier beach which separates Grays Harbor from the ocean; it is a setting much like the other southern coast sites. Excavations here produced a relatively large collection of late prehistoric to early historic artifacts (ca. 1,200 items) and faunal remains (Roll 1974).

Erosion of the bank at the Ozette Village Site during the winter of 1970 resulted in the discovery of a water-logged portion of this site with well-preserved organic cultural materials. The exposed strata contained the remains of at least five late prehistoric split-cedar plank longhouses and their contents. Among the latter were large numbers of perishable wooden and woven plant fiber artifacts without precedent from Washington coast sites. Daugherty and a team from Washington State University returned to the site, and this area was the focus of sustained archaeological activities for the next 11 years. Ozette Archaeological Project efforts in the "wet" portion of 45CA24 resulted in the excavation of three complete longhouses, a portion of a fourth, and much of the contemporaneous exterior deposits around them; the recovered collection included about 60,000 artifacts and 1,000,000 faunal remains (Gleeson and Grosso 1976; Gleeson 1982). As such, it is something of an understatement to suggest that the findings from Ozette dominate our perceptions of the late prehistory of the northern Washington coast.

During the 1970s, a number of smaller excavation efforts were also conducted on the Washington coast in association with the on-going work of the Ozette Archaeological Project. The most extensive of these was a testing program conducted in the vicinity of Cape Flattery by Edward Friedman. Five late prehistoric to early historic shell midden sites, 45CA22 (the Neah Village

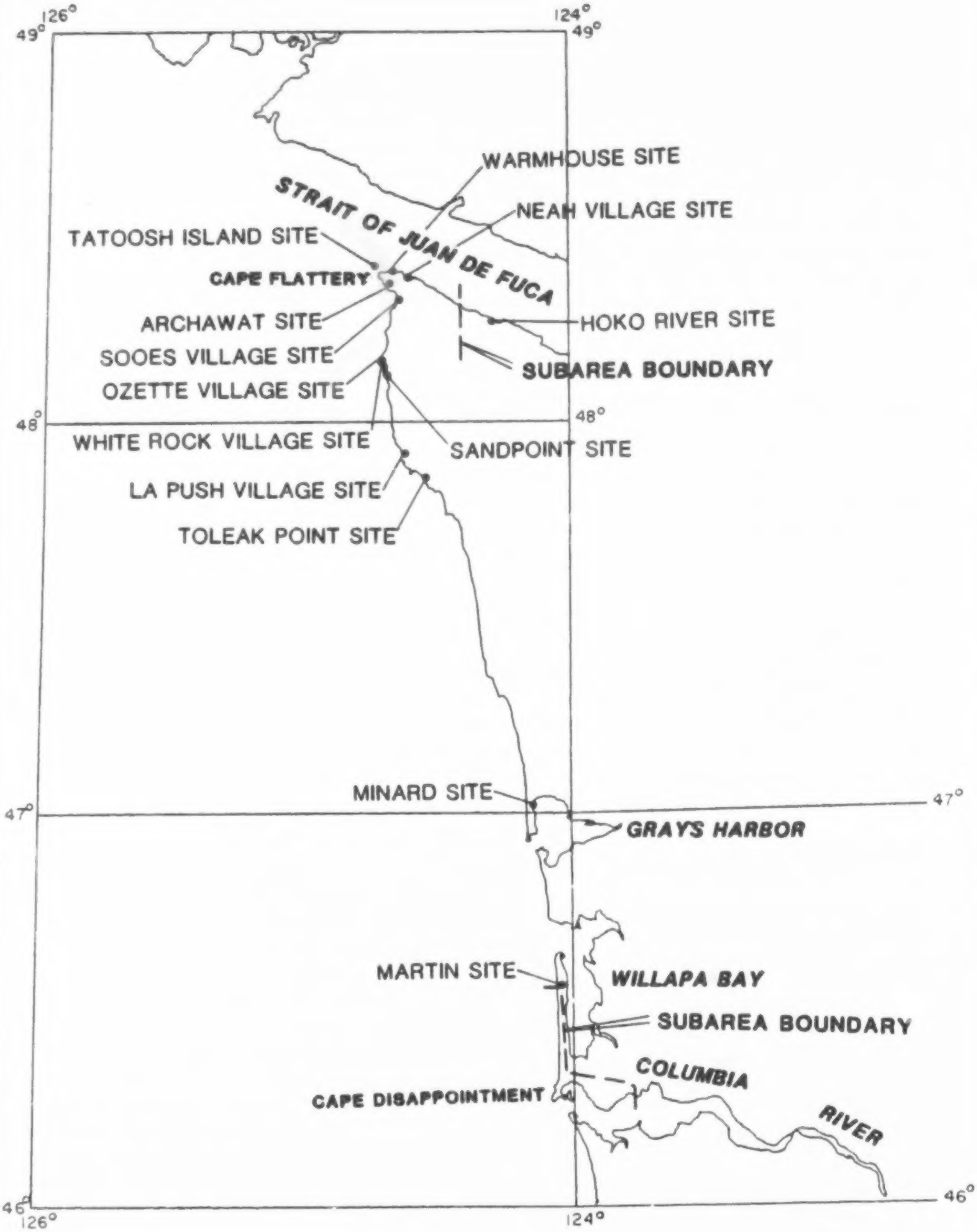
126°
49°
124°
49°
WARMHOUSE SITE
STRAIT OF JUAN DE FUCA
NEAH VILLAGE SITE
TATOOSH ISLAND SITE
CAPE FLATTERY
ARCHAWAT SITE
HOKO RIVER SITE
SOOES VILLAGE SITE
SUBAREA BOUNDARY
OZETTE VILLAGE SITE
48°
48°
WHITE ROCK VILLAGE SITE
SANDPOINT SITE
LA PUSH VILLAGE SITE
TOLEAK POINT SITE
MINARD SITE
47°
47°
GRAYS HARBOR
MARTIN SITE
WILLAPA BAY
SUBAREA BOUNDARY
COLUMBIA
CAPE DISAPPOINTMENT
RIVER
46°
46°
126°
124°

Figure III-12. Archaeological Sites Mentioned in Text for the Washington Coast.

Site), 45CA25 (the Sooes Village Site), 45CA204 (the Warmhouse Site), 45CA206 (the Archawat Site), and 45CA207 (Tatoosh Island), were tested and the small recovered collections of artifacts (ca. 250 or fewer from each site) and faunal remains were compared to a similar sample from Ozette (Friedman 1976a,b). In a similar context, Wessen tested 45CA201 (the Sand Point Site), a somewhat older late prehistoric shell midden associated with a relict beach feature several miles south of Cape Alava. Here again, a small sample of artifacts (63 items) and faunal remains were compared to the Ozette collection (Wessen 1984).

Elsewhere on the coast, still other excavation programs occurred. Archaeological teams from Washington State University returned to 45PC7 in 1974 and again in 1976. These efforts followed up on Kidd's earlier work here; examining more of the site area and adding about 100 items to the available sample of artifacts (Shaw 1977; Brown 1977). Two small testing programs were also undertaken at 45CA23 (the La Push Village Site) during the 1970s. (This is one of the sites described by Reagan in 1917). Both were associated with cultural resource management studies. Shell midden deposits exposed during the installation of sewers were described by Mary Ann Duncan of the University of Washington (Duncan 1977; 1981). Similar deposits in a nearby area developed by the U.S. Coast Guard were described by Wessen (1977). Both produced only small samples of late prehistoric to early historic cultural materials.

After the termination of excavations at Ozette in 1981, the pace of field work declined throughout the region. In recent years, only a single additional excavation project has been conducted on the outer coast of Washington. In 1988, Wessen conducted limited additional testing at 45CA22, a site earlier tested by Friedman. While this most recent effort produced few additional artifacts, radiocarbon dates demonstrated that occupation here has persisted considerably longer than Friedman's work indicated (Wessen n.d.).

In total, archaeological site survey and excavation efforts on the Washington coast have produced a body of data which is relatively large when compared to the Columbia River mouth, but still substantially smaller than that available for the Oregon coast. Within the area defined by this study, 95 prehistoric archaeological sites have been recorded and at least limited excavation data is available for 11 of them. Reflecting the relative recency of these excavation efforts, 10 of the 11 sampled sites are represented by at least one radiocarbon date. While some of these excavations, and related analyses, have yet to be completely reported, at least limited accounts are available for all of them.

The data from the Washington coast also exhibits all of the biases and other inherent limitations noted in earlier discussions of the Oregon coast and Columbia River mouth data. For the most part, these conditions closely parallel those noted above. All of the sampled sites are relatively recent occupations and all are shell midden deposits. As was the case for Oregon, these biases reflect the actual character of the currently known prehistoric resources of this area. Additionally, the Washington coast data is also marked by a strong geographic bias not characteristic of the latter areas. Nine of these 11 sampled sites are located along an approximately 60-km stretch of the northernmost portion of the coast; the remaining 300 km of the Washington coastline are represented by only two excavated sites.

Analytical difficulties identified by Lyman and Ross (1988) for the Oregon coast (i.e., implicit or non-existent research designs, small artifact sample sizes, incomplete and inaccurate reporting of data, and ambiguous use of analytical and conceptual terms) are, to varying degrees, also relevant to the Washington coast data. Here, however, these conditions are less directly related to the requirements and realities of small-scale cultural resource management excavations; in fact, given the remote nature of this area, cultural resource management excavations have had only a very limited impact on the Washington coast. While it is the case that most Washington coast excavations have been university-based research efforts, rather than cultural resource management efforts, it is fair to say that they have often been conducted in the absence of clearly articulated regional research goals which could facilitate the coordination and/or integration of the various project findings.

2.6.2 *Culture History*

Consistent with the rest of the coastal Pacific Northwest region, Washington coast culture history is only poorly known. Once again, the reasons for this condition should be apparent in observations noted just above. Nevertheless, at least the broad outlines of this culture history can be described. In order to increase the comparability of this account, discussion here will also utilize the basic structure presented in the other Northwest Coast culture histories offered above. This includes review of cultural-historical units with reference to the statewide temporal scheme recently developed in Oregon (Gilsen 1989) and consideration of archaeological materials from other nearby areas when they offer potential insights into Washington coast prehistory.

Known environmental and cultural conditions on the Washington coast strongly suggest that the northern and southern portions of this area may have culture histories which differ significantly in some details. In this regard, the geographic bias in the available archaeological data figures prominently; the vast majority of the available data reflects only the northern coast; the southern coast is much more poorly known. Potential limitations imposed by this situation, however, are at least partially mitigated by the observation that the very small body of data from the southern Washington coast suggests that this area's culture history probably shares much with the somewhat better-documented Columbia River mouth immediately to the south. Conversely, the northern Washington coast with its more distinctive culture history is, relatively speaking, much better documented. At this time, there are no proposed cultural chronologies which directly address the southern Washington coast. A single proposed chronology is available for the Olympic Peninsula of Washington (Bergland 1983), and it will be utilized as the basis of this account.

2.6.2.1 Early Prehistoric Period

The earliest cultural-historical unit in Bergland's (1983) chronology is the Early Prehistoric period. He offers a brief sketch of this early period, but conceptions of it are limited by the lack of well-documented examples. On the Washington coast proper, there are currently no known examples, well-documented or otherwise. Apparently relying on data from nearby areas, Bergland visualizes it as representing hunting and gathering groups oriented predominantly toward terrestrial resources. He places the Early Prehistoric period between ca. 12,000 and 6,000 years ago.

The oldest representative of this period is 45CA218 (the Manis Mastodon Site) located on the northeastern Olympic Peninsula, some 110 km from the ocean. This site contains the remains of an apparently butchered mastodon which has been radiocarbon dated to ca. 12,000 B.P. (Gustafson et al. 1979). Unfortunately, only a very few artifacts have been encountered in association with this animal. None of the latter are diagnostic of any known early tradition and thus the cultural affiliation of this site is unknown. Given the date, Carlson (1990) speculates that 45CA218 may represent an expression of the FPT, but this remains undemonstrated. In this regard, it is worth noting that a few other isolated examples of fluted points have been reported from the Puget Sound Basin of western Washington (Osborne 1956; Wessen 1988a:68). As such, representatives of the FPT, may have occasionally reached the Washington coast, but their presence appears limited at best.

Bergland (1983) also notes a few localities along the northern and eastern flanks of the Olympic Peninsula where probable examples of the PTT occur. Since his writing, one additional site of this type has been reported on the southeastern Olympic Peninsula (Wessen 1990a). Still other examples are known from elsewhere in the Puget Sound Basin, where they are usually referred to as "Olcott" sites (Matson 1985), and from locations in interior southwestern Washington (Dancey 1968; Kennedy 1973). While very few such localities have been dated, it appears likely that at least some of these western Washington PTT sites are Early to Mid Holocene in age. In light of their widespread occurrence, similar materials will probably be found along the Washington coast as well.

Somewhat further afield, there are at least a few tantalizing suggestions that representatives of the early SPT may also have been present in western Washington. Large stemmed points, potentially related to this tradition, have been reported in interior southwestern Washington (Welch n.d.) and at one locality along the western flank of the Cascade Mountains (Schalk and Taylor 1988). (Recall that additional examples have also been reported in northwestern Oregon close to the Columbia River mouth; see Section 2.5.2.1.) To date, none of the potential western Washington expressions have been well-described.

Beyond the observation that there probably were people on, or at least near, the Washington coast at this time, it is difficult to say a great deal about them. While Bergland's (1983) Early Prehistoric period is currently an acceptable cultural-historical unit, it would appear to include evidence of more than one cultural tradition. Based upon the available data, it can be suggested that the PTT appears to have been the predominant early culture here; representatives of the FPT and SPT may also have passed this way, but their presence appears much more limited. In terms of the statewide temporal scheme recently developed in Oregon (Gilsen 1989), the Early Prehistoric Period of western Washington probably equates with the former's Paleo-Indian and Early Archaic periods.

2.6.2.2 Middle Prehistoric Period

The second cultural-historical unit in Bergland's (1983) chronology is his Middle Prehistoric period. Once again, conceptions of the unit are limited by the lack of well-documented examples of it. On the Washington coast proper, there are currently no known examples, well-documented or otherwise. (An earlier reported date of ca. 6,000 B.P. for 45CA201 (Friedman 1976a:31) has been contradicted by subsequent study of this site (Wessen 1984) and is no longer considered credible.) Elsewhere on the southern Northwest Coast, examples are rare at best. Again relying on data from nearby areas (principally the Lower Fraser River of southwestern British Columbia), Bergland visualizes it as representing groups which utilized a mix of marine and terrestrial resources. As a matter of speculation, he places the Middle Prehistoric period between ca. 6,000 and 3,000 years ago. A number of different factors probably contribute to the apparent scarcity of Middle Prehistoric sites in western Washington, one if which is surely the lack of secure dates for most of the known sites here. Thus, it is possible that some sites attributed to the preceding Early Prehistoric period are really Middle Prehistoric sites. In this light, it is difficult to relate the Middle Prehistoric period of the Washington coast to Oregon's statewide temporal units, but it is at least roughly equivalent to either the Early or Middle Archaic periods.

Given the very limited data available, it is difficult to say much about the Middle Prehistoric period of western Washington. A broader regional perspective indicates that several different technological traditions are still apparent on the southern Northwest coast, but there is currently no basis to suggest which among them was present on the Washington Coast at this time. However, it is likely that significant maritime adaptations were established during this period, if not before. On the marine shorelines of Puget Sound, the earliest known shell midden deposits date to ca. 4,100 B.P. (Grabert and Larsen 1975). Similarly, on the central Oregon coast, the use of marine fish has been documented as early as ca. 8,000 B.P. and the formation of shell midden deposits was occurring by ca. 5,200 B.P. (Minor and Toepel 1986). On the west coast of Vancouver Island, marine fishing pre-dates ca. 4,200 B.P. and shell midden deposits begin to appear here shortly after this time (Dewhirst 1980). The earliest dates for shell midden deposits on the east coast of Vancouver Island and the southern mainland of British Columbia are also ca. 4,000 to 4,500 B.P.; evidence of marine fishing and sea mammal hunting are present in both areas at least several thousand years earlier (Matson 1976, 1988; C. Carlson 1979). In light of this regional pattern, it must be considered likely that similar cultural developments were occurring on the Washington coast as well.

2.6.2.3 Early Maritime Period

The next cultural-historical unit is the Early Maritime period. It represents from ca. 3,000 to 1,000 B.P., but Bergland acknowledges that the initial date is arbitrary and "...reflects a near-total lack of specific information about the preceding developments of the Middle Prehistoric period" (1983:54). It is also the first period for which there are currently known examples from the Washington coast. At least four sites are known to contain deposits from this period; three are from northern Washington and one from southern Washington. As the name implies, it is seen as a period of developed maritime cultures. However, as noted above, it is likely that significant maritime activities were occurring prior to this time. While there are important assemblage differences, an attempt to characterize the Early Maritime period of the Washington coast in terms of Oregon's statewide temporal units would lead to the conclusion that it is probably equivalent to the Middle Archaic period.

Northern Washington sites with Early Maritime components include 45CA24 (Daugherty 1970) and 45CA201 (Wessen 1984), extensive shell midden deposits along the rocky ocean shore, and 45CA213 (Croes and Blinman 1980; Howes 1982), a complex of waterlogged and adjacent dry non-shell cultural deposits at the mouth of the Hoko River on the Strait of Juan de Fuca. All three contain evidence of sophisticated maritime cultures in place on the Washington coast about 2,000 to 3,000 years ago. To date, Early Maritime components from the former two sites have yielded only relatively small samples of stone and bone or antler artifacts. Indications of chipped stone are not uncommon, although finished objects are rare. Among the latter, various scrapers, modified flakes, flaked cobble spalls, and cobble tools are well-represented. Chipped stone projectile points have not been reported. Ground and pecked stone is well represented in these assemblages; commonly occurring examples include ground slate knives, adze blades, abrader/whetstones and pecked stone girdled netstones. Bone or antler artifacts are also common, often in the form of unipoints, bipoints, unilaterally barbed points, composite toggling harpoon valves, wedges, and decorated objects like pendants.

Perceptions of Early Maritime period material provided by these North Coast shell midden sites have been complemented and enhanced by the range of normally perishable plant fiber artifacts recovered from waterlogged deposits at 45CA213 (Ayers 1980). In addition to stone and bone objects, this collection also contains many carved wooden and woven and/or twisted plant-fiber artifacts. Fragments of basketry and cordage are particularly common, although scraps of garments, hats, mats, and nets are also reported. A wide variety of wooden fishhooks are also present. Decorated renderings similar to the above-noted bone objects are also seen on wooden tools here. In comparison to these plant fiber materials, the sample of bone tools from the site is relatively limited and much like those encountered from the shell midden sites. The stone tool sample is also much like those from the contemporaneous shell middens, but is marked by a bi-polar reduction technology used to produce microliths (Flenniken 1980). While the former sites contain only limited evidence of the use of bi-polar reduction, it is well-represented at 45CA213.

Only very limited data is available from the southern Washington coast at this time, and it presents a picture in some contrast to the assemblages just described. Material known to date to this period is currently available from only one site, 45PC7, a shell midden on the North Beach Peninsula between the ocean and Willapa Bay (Kidd 1967; Shaw 1977). Excavations here have produced a sample of bone and stone artifacts. Both the bone tool and the pecked and ground stone tool assemblages from this site are much like those reported to the north and, for that matter, to the south in northwestern Oregon as well. The only readily apparent difference in this regard is that the ground slate knives found to the north do not occur here. However, the chipped stone sample from 45PC7 is clearly distinct from the northern Washington coast sites. Chipped stone is well-represented at this site, the most commonly occurring objects being small projectile points. Among these, triangular and narrow-necked stemmed forms are dominant. Thus, while the collection is not directly equivalent to the Ilwaco Phase of the nearby Columbia River mouth (Minor 1983), it does exhibit obvious similarities with that latter area.

2.6.2.4 Prehistoric Northwest Coast Period

The Prehistoric Northwest Coast period is the last prehistoric cultural-historical unit in Bergland's (1983) chronology. As implied by the name, it is essentially ethnographic Northwest Coast culture in a late prehistoric context. It also exhibits many shared attributes with the preceding Early Maritime period. In fact, Prehistoric Northwest Coast period assemblages differ from the latter principally in that indications of chipped stone are now virtually non-existent. The apparent disappearance of chipped stone occurred ca. 1,500 to 1,000 years ago, and Bergland places the period from ca. 1,000 to 200 B.P. This change occurs without apparent parallel changes in any other aspect of economy or technology, and its cultural significance is uncertain. Most of the excavated site data from the Washington coast represent this period; once again, these are all shell midden sites and most are on the northern coast. While there are significant assemblage differences, the Prehistoric Northwest Coast period of the Washington coast is unquestionably equivalent to the Late Archaic period of Oregon's statewide temporal scheme.

By far the best Prehistoric Northwest Coast period data come from approximately 350-year-old waterlogged deposits at 45CA24 (Gleeson and Grosso 1976; Gleeson 1982). This portion of the site contains the remains of at least four large split-cedar plank houses and all of the materials typically associated with them. The vast recovered sample includes virtually all classes of bone and stone artifacts represented in the earlier Early Maritime period, plus large numbers of wooden and woven and/or twisted plant fiber artifacts very much like those described in ethnographic accounts from the Northwest Coast. These perishable materials are also much like the older plant fiber artifacts from 45CA213, but this collection is far larger and includes many types of artifacts not represented at the Hoko River site. In addition to large quantities of basketry and cordage, other well-represented artifact classes include: structural remains (wall, roof, and bench planks and various types of posts), fishing gear (hooks, lures, and spreader bars) sealing and whaling gear (harpoon points, shafts, killing lances, float plugs, and clubs), woodworking gear (wedges, chisels, and various types of adzes), weaving gear (looms and spindle whorls), bows and arrows, and boxes. Many of the tool types previously made of chipped stone have been replaced by functionally equivalent items made of bone, wood, ground mussel shell, and, in some cases, iron. While a few examples of chipped stone tools have been recovered from these houses, no debitage is present and it is likely that these objects represent trade items.

Prehistoric Northwest Coast period data from the southern Washington coast are limited to material from a single site, and as was the case during the previous Early Maritime period, a contrasting pattern is clearly evident. Further, the contrast is essentially that noted during the previous period. Excavations at 45GH15, a shell midden deposit on the northern shore of Grays Harbor, have produced a late prehistoric sample which differs from contemporaneous collections to the north and has parallels to the somewhat earlier 45PC7 materials to the south (Roll 1974). The bone and stone artifacts from 45GH15 include bone tools and pecked and ground stone tools much like those reported to the north and to the south in northwestern Oregon as well. Ground slate knives, apparently absent to the south and common to the north, are represented here by only a single specimen. While chipped stone is not abundant, several dozen

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chipped stone tools have been recovered and most of the latter are small triangular and narrow-necked stemmed projectile points. Thus, once again the collection is not directly equivalent to the Ilwaco Phase of the Columbia River mouth (Minor 1983), but it does exhibit obvious similarities with this latter area.

2.6.3 *Ethnography*

Given the many strong continuities between the Prehistoric Northwest Coast period and the cultures of the ethnographic period of the Washington coast, there can be little doubt that the latter represent the direct descendants of the former. With the exception of the appearance of early historic trade goods, there is little apparent difference in the material culture assemblages between the two periods (Wessen 1990b). Similarly, the contrasts between the northern and southern coasts in late prehistoric times are equally apparent in the ethnographic record.

The ethnographic peoples of the Washington coast (Figure III-13) represent three major language groups, within which a number of more local tribal or band groups may be recognized. From south to north, these major language groups are Salishan, Chimakuan, and Wakashan. Salishan speakers occupied the largest portion of the coast, ranging from Willapa Bay north through the Queets River watershed; they included the Lower Chehalis, Humptulips, Copalis, Quinault, and Queets tribes. To the north of the Queets River, the Chimakuan Hoh and Quileute tribes occupied much of the watersheds of the Hoh and Quillayute rivers. Finally, the northwestern corner of the Olympic Peninsula was held by the Wakashan-speaking Makah Tribe. Estimates of early Contact period populations prepared by Mooney (Kroeber 1939:135-136) indicate that these Washington coast groups may have represented as many as 6,000 individuals; estimates presented by Taylor (1963:163) are somewhat higher. Given the possibility that introduced diseases may have reached this area from California slightly prior to this time (Boyd 1985), a significantly larger late prehistoric population may have been present.

Ethnographic descriptions of these groups are highly uneven in scope, content, and credibility. Some groups are the subject of numerous accounts and others are virtually undocumented. For this reason, the following summaries of the language, territory, subsistence, and settlement patterns sometimes collectively consider two or more adjacent groups. Such "lumping" is only conducted when the available data suggest a high degree of similarity among the groups; in some cases, a poorly documented group or groups are considered together with a better-documented neighbor. This approach is not intended to imply that such amalgamations necessarily represent a single tribal entity.

2.6.3.1 Lower Chehalis/Humptulips/Copalis

Language: All three of these groups spoke coast Salish languages. Ruby and Brown (1986:83) suggest that Humptulips was, in fact, a dialect of the Lower Chehalis language. Copalis appears to have been a closely related, though distinct, language.

Territory: The Lower Chehalis are generally considered to have held much of the southern shore of the lower reaches of the Chehalis River, the south side of Grays Harbor, and the Washington coast south to, and including much of, Willapa Bay (Swanton 1952:18). With respect to the last of these areas, it is probable that Chinookan peoples formerly occupied much of Willapa Bay, but were replaced by the Lower Chehalis early in the historic period (Ray 1938:36). Humptulips people held much of the northern shore of the lower reaches of the Chehalis River and the north side of Grays Harbor; they do not appear to been present on the coast itself (Swanton 1952:27). The Copalis occupied lands to the north of the Humptulips. They controlled the Copalis River watershed and nearby portions of the Washington coast (Swanton 1952:25).

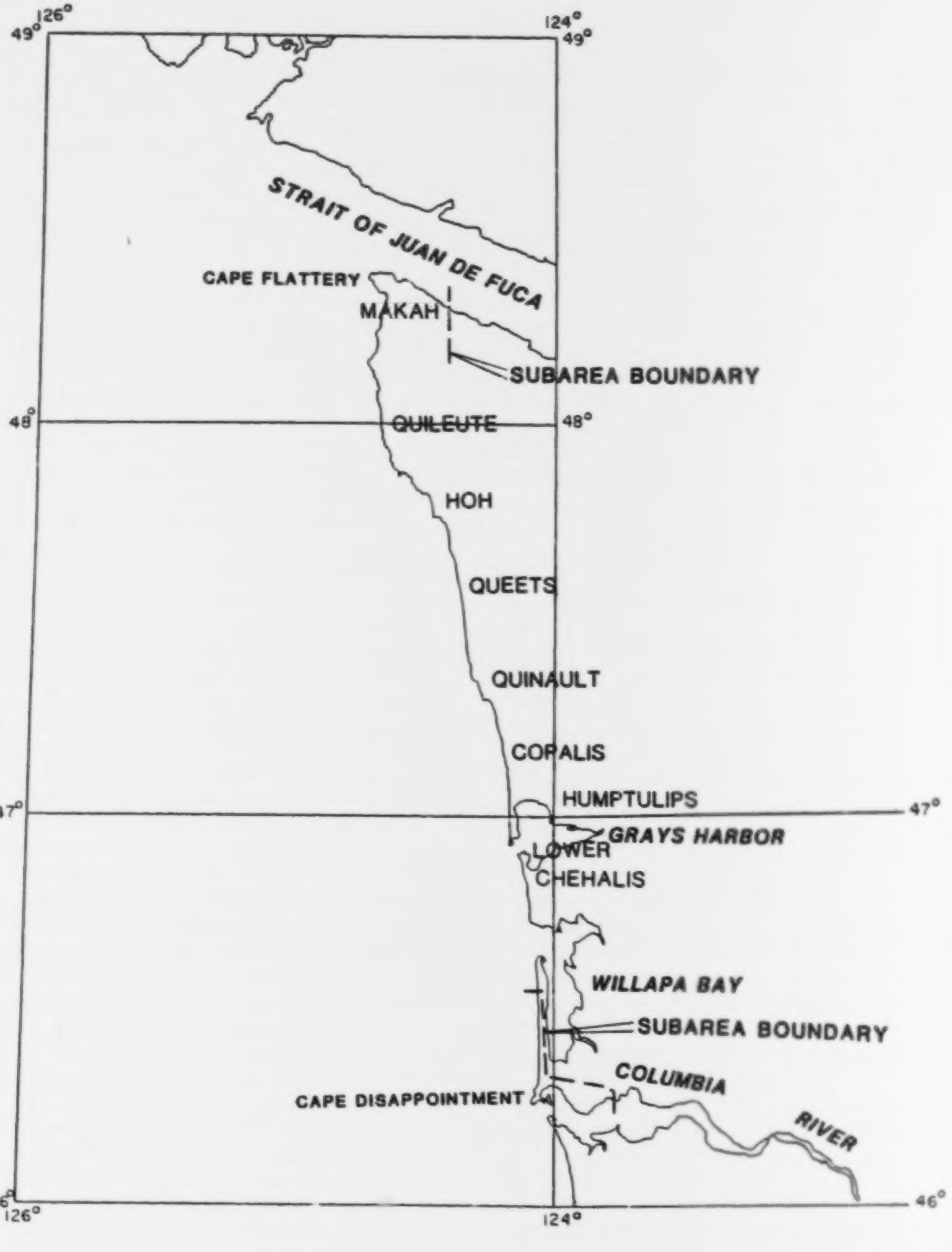
126°
49°
124°
49°
STRAIT OF JUAN DE FUCA
CAPE FLATTERY
MAKAH
SUBAREA BOUNDARY
48°
QUILEUTE
48°
HOH
QUEETS
QUINAULT
COPALIS
HUMPTULIPS
47°
47°
GRAYS HARBOR
LOWER
CHEHALIS
WILLAPA BAY
SUBAREA BOUNDARY
COLUMBIA
CAPE DISAPPOINTMENT
RIVER
46°
126°
124°
46°

Figure III-13. Ethnographic Groups of the Washington Coast.

Subsistence: All three of these groups exploited a wide range of marine, riverine, and terrestrial resources. Overall, however, their subsistence orientation appears to have had a distinct estuarine focus. Fish were a staple of the diet. While anadromous species such as salmon and steelhead may have been particularly prominent, it is likely that a wide variety of other nearshore marine fishes were also important. Marine shellfish and waterfowl were important, as were large terrestrial mammals such as deer and elk. The harbor seal and sea lion were important, but there are few indications of the use of pelagic mammals and most marine hunting appears to have occurred within protected water settings. The Lower Chehalis and Copalis probably had periodic access to dead whales. Plant resources were limited largely to berries, roots, and sprouts, and may have been a relatively minor part of the diet.

Settlement: All three of these groups moved seasonally, dividing their time between relatively large stable "winter" villages and smaller seasonal resource-oriented camps. The principal structure of the village was a large split-cedar plank building which housed an extended family unit. The structure was vertically planked with a gable roof. Villages consisted of a relatively small number of such structures and were invariably situated near water; along lower river shores, at important confluences, on inner bay shores, and at the entrances to the bay (Wessen 1983). Villages located along the outer coast appear to have been uncommon. Seasonal resource camps were probably relatively small settlements marked by temporary pole-frame structures covered with either mats or brush. They might occur in a wide range of settings from the ocean beaches to upland areas in the interior.

2.6.3.2 Quinault/Queets

Language: Both of these groups appear to have spoken the same coast Salish language (Thompson 1973:1007). While there may have been dialectical differences between them, this is unclear in the very limited data available for them.

Territory: The Quinault and Queets peoples held similar traditional territories, each occupying the watershed of the river named for it and coastal areas nearby. Thus, the Quinault held the Quinault River Valley and the coast to south, at least as far as Moclips (Swanton 1952:38). To their north, the Queets held the Queets River Valley and a portion of the coast to the north (Swanton 1952:37). The coastal boundary between these two is unclear, but may have been somewhere in the vicinity of the Raft River.

Subsistence: Consistent with all other Washington coast groups, the Quinault and Queets exploited a wide range of marine, riverine, and terrestrial resources. Anadromous and marine fish were a staple of the diet, and both groups were particularly well-known for their rich riverine fisheries. Large terrestrial mammals, marine shellfish, and waterfowl were also important, as were various marine mammals. Beyond harbor seal, sea lion, and sea otter, Olson (1936:44) reports that the Quinault also hunted whales; the antiquity of this last activity is uncertain however, and it may have been a relatively recent addition to their subsistence base. Plant resources were limited largely to berries, roots, and sprouts, and may have been a relatively minor part of the diet.

Settlement: Again consistent with other Washington coast groups, the Quinault and Queets moved seasonally, dividing their time between relatively large stable "winter" villages and smaller seasonal resource-oriented camps. The principal structure of the village was a large split-cedar plank building which housed an extended family unit. Like their southern neighbors, a vertically planked gable-roof structure was favored (Olson 1936:61). Many villages consisted of a relatively small number of such structures and all such villages were located along the shores of the principal river in their respective territories (Wessen 1983). The largest village for each group was located at the mouth of each river, and other villages were present at important confluences upstream. Seasonal resource camps were probably relatively small settlements marked by temporary pole-frame structures covered with either mats or brush. They might occur in a wide range of settings from the ocean beaches to upland areas in the interior.

2.6.3.3 Quileute/Hoh

Language: The Quileute and Hoh were the only Chimakuan speakers on the Washington coast. Thompson (1973:1000-1002) implies that they both spoke the same language and, similar to the preceding case, while some dialectical differences may be involved, this is unclear in the data available for them.

Territory: The Quileute and Hoh peoples held similar traditional territories, each occupying the watershed of the river named for it and coastal areas nearby. The Quileute lived along the Quillayute River and its major tributaries, the Bogachiel, Calawah, and Soleduck rivers (Swanton 1952:38), while the Hoh occupied the Hoh River Valley to the south (Swanton 1952:27). Both of these groups also had a significant presence on the coast itself, although coastal boundaries between them and with their northern and southern neighbors are uncertain.

Subsistence: The Quileute and Hoh exploited a wide range of marine, riverine, and terrestrial resources. In some contrast to their southern neighbors, however, these groups appear to have been somewhat more maritime, rather than riverine, oriented (Singh 1956:48). Anadromous and marine fish were a staple of the diet, and marine mammals may have been equally important. In this latter regard, late prehistoric archaeological deposits at La Push (the principal Quileute village) contain abundant evidence of the use of pelagic marine mammals such as fur seal and whale (Duncan 1981). Large terrestrial mammals, marine shellfish, and waterfowl were also important. As was the case for all other Washington coast groups, the use of plant resources appears to have been limited largely to berries, roots, and sprouts, and may have been a relatively minor part of the diet.

Settlement: Seasonal movement between relatively large stable "winter" villages and smaller seasonal resource-oriented camps was also a characteristic of Quileute and Hoh settlement patterns. The principal structure of the village was a large split-cedar plank building which housed an extended family unit. According to Curtis (1913:147), the Quileute preferred a house with horizontal planking and single-pitch shed roof. Villages were located along the shores of the major river in their respective territories and along the coast at the mouths of larger streams (Wessen 1983). The largest village for each group was located at the mouth of their respective major river. Seasonal resource camps were probably relatively small settlements marked by temporary pole-frame structures covered with either mats or brush. Smaller plank structures may also have been used. They might occur in a wide range of settings from the ocean beaches to upland areas in the interior.

2.6.3.4 Makah

Language: The Makah were the only Wakashan speakers on the Washington coast (Jacobsen 1980).

Territory: The Makah people occupied the northwestern tip of the Olympic Peninsula of Washington, but since the area lacks major rivers, it is difficult to describe their territory with respect to major river watersheds. They held the Pacific coast at least as far south as Cape Alava and the southern shoreline of the Strait of Juan de Fuca at least as far east as the vicinity of the mouth of the Hoko River (Swan 1869:1). The Makah had a regular presence on Tatoosh Island and it is worth noting that they also considered an extensive area of the ocean adjacent to this area to be a part of their traditional territory as well.

Subsistence: While exploiting a wide range of marine, riverine, and terrestrial resources, the Makah were clearly the most maritime-oriented group on the Washington coast.

Marine fish and marine mammals were probably the core of their diet. The early historic Makah people were particularly well known as whalers (Swan 1869), and late prehistoric archaeological deposits at Cape Alava demonstrate that pelagic marine mammals such as fur seal were also of great importance to them (Gustafson 1968). Among a wide variety of marine fish, halibut and ling cod were particularly prominent (Huelsbeck 1983). Anadromous fish were also important, being obtained from both salt water and from local rivers. Marine shellfish, waterfowl, and large terrestrial mammals were also important. As was the case for all other Washington coast groups, the use of plant resources appears to have been limited largely to berries, roots, and sprouts, and may have been a relatively minor part of the diet.

Settlement: Like all other Washington coast groups, the Makah have been described as moving seasonally between relatively stable "winter" villages and other seasonal resource-oriented camps. However, archaeological data from some late prehistoric Makah villages suggest that they may have been occupied through much of the year (Wessen 1982; Huelsbeck 1983). The principal structure of the village was a large split-cedar plank building which housed an extended family, horizontal planking and single-pitch shed roof, being the preferred form (Mauger 1978). Villages consisted of from eight to 15 of these structures and such villages were invariably located along the coast (Wessen 1983). While some were situated at the mouths of larger streams, this does not seem to have been the critical factor and proximity to important marine resources may have been equally important. Some seasonal resource camps were probably small settlements, although others appear to have been relatively large. Such camps were marked by temporary pole-frame structures covered with either planks, mats, or brush. Summer halibut camps also contained large outdoor fish-drying racks. Makah resource camps appear to have been largely on or near the coast as well (Friedman 1976a,b). In this capacity, they occupied Tatoosh Island and numerous other coastal localities, and were certainly present in the interior in lower river valleys and in the vicinity of Lake Ozette. However, there is little reason to consider that they had a significant presence in upland areas in the interior.

2.6.4 *Settlement and Subsistence Systems*

The predictive aspects of the MMS study require that the existing cultural data be utilized in order to reconstruct the general distribution and patterning of contemporaneous human occupations (i.e., sites) over a landscape. Further, given the time range of interest to this study, it is appropriate to address potentially different patterns at different times during this period. A fundamental assumption in this process is that, when emergent, the now subtidal continental shelf areas offered environmental conditions similar to those reported for adjacent coastal terrestrial surfaces. As such, it is useful to consider what the available data indicate about coastal land use patterns in the study area. The following subsections present accounts of site types and distributions, Late Pleistocene/Early Holocene settlement and subsistence systems, and late prehistoric settlement and subsistence systems.

2.6.4.1 Site Types and Site Distributions

An initial approximation of the character of patterned relationships between a group of contemporaneous sites can be obtained by consideration of the types of sites involved and their distribution within the landscape. While such a consideration is presented below, the preceding review of the available data for the Washington coast demonstrates that it is marked by significant biases and other inherent limitations which restrict our view of these issues.

As noted, biases and limitations in the existing Washington coast database are considerable, and broadly equivalent to those which characterize the Oregon coast and Columbia River mouth data. Once again, these problems are particularly apparent with respect to the determination of site types. Detailed assessments of the character (and potentially the function) of individual sites can only be made with the findings of adequate sampling and, as relatively few sites have been sampled and most which have are represented by only small samples, such assessments are often difficult. Similarly, site record data generated during surveys are invariably limited and offers only a very generalized basis for the construction of site typologies.

In some contrast to the situation on the Oregon coast and at the Columbia River mouth, there have been no functional site typologies proposed on the basis of archaeological criteria for the Washington coast. In this regard, it is worth considering that Friedman (1976a, 1976b) tested a number of ethnographically identified Makah "villages" and "camps", in part to determine whether there were readily discernible archaeological characteristics which could be utilized to distinguish between these functional types. The results of his small-scale testing showed that basic characteristics of site size and midden composition (i.e., artifact and fauna counts and class diversities) were not sufficient to consistently distinguish between these functional types. This finding can be seen as a corroboration of the Lyman and Ross (1988) contention that these types of criteria can be seriously influenced by sample size.

Given the available data, this discussion of Washington coast site types will rely upon a highly generalized typology based on the gross physical character of the dominant cultural materials involved. From this perspective, four general types of sites may be recognized: shell middens, rock art sites, wet sites, and burial grounds. (As used here, all of these types are directly equivalent to those noted for the Oregon coast; see Section 2.4.4.1.) Consistent with other coastal areas of the Pacific Northwest, nearly all (approximately 88 percent) of the sites are shell middens. All other types of sites are far less common; among them, rock art sites account for half of all non-shell midden sites.

The term "shell midden" is here used only to indicate that a cultural deposit contains a significant fraction of marine shell. No specific functional connotation is implied and, given the overwhelming predominance of this type, there can be no doubt that significant functional variation occurs among sites which contain marine shell refuse. In fact, all of the villages and camps tested by Friedman (1976a, 1976b) are shell middens. Thus, the "lumping" of these sites into a single group should be seen as a recognition of the view that we cannot currently distinguish types among them, rather than as a suggestion that they all represent the same type of occupation.

Shell midden sites are well-represented on all portions of the Washington coast. They occur in a wide variety of local landscape settings and exhibit a distinct north to south variation which parallels the local landscape variation over this same area. On the northern Washington coast, almost all shell midden sites occur in relatively exposed outer coast settings including on islands off the coast. Bay and estuary settings are uncommon and there is little tendency for sites to be concentrated in them. In contrast, the southern Washington coast is marked by extensive protected bay and estuary shorelines and most of the known sites are located in these areas. While shell midden sites do occur in exposed outer coast settings on the southern Washington coast, they are relatively uncommon.

While far less common, rock art sites are the second-most abundant type of site known to occur on the Washington coast. In all cases, these are concentrations of petroglyphs rendered on beach boulders; common motifs include anthropomorphic, zoomorphic, and geometric elements. In almost all cases, they are located near, and may be associated with, shell midden sites. The distribution of rock art sites on the Washington coast is strongly patterned, all such sites being restricted to the northernmost 30 km of this area. This distribution closely approximates the range of traditional Makah territory on the outer coast of Washington.

The two remaining site types on the Washington coast are currently represented by such small samples of sites that it is difficult to offer many generalizations about them. Two sites are specifically identified as "burials", but neither has been subject to any degree of formal study and little is known about them. In one case (45PC8), the burials may be associated with rock cairns, a pattern occurring widely in coastal Washington and British Columbia (Smith and Fowke 1901), but apparently rare on the Oregon coast. Both of these burial sites may have been associated with nearby shell midden sites and, in this regard, it is worth noting that a number of Washington coast shell middens are known to contain human burials even though they are not identified as burial grounds. Finally, there are at least three sites on the Washington coast which contain "wet" deposits with well-preserved plant fiber artifacts. Two of them are alignments of preserved wooden stakes representing fish weirs located within a bay or lower river channel; the last is an area of waterlogged strata within a large shell midden site.

2.6.4.2 Late Pleistocene/Early Holocene Settlement and Subsistence Systems

Data and discussion presented thus far make it clear that there is only a very limited and indirect basis for speculations regarding the nature of possible Late Pleistocene/Early Holocene settlement and subsistence systems on the Washington coast. At this time, there are no data from the coast itself and the limited data from other nearby areas occur within the context of competing models for the early prehistory of the entire Northwest Coast region. The maritime cultures of the Northwest Coast during the Late Holocene have been variously proposed to be derived from: (1) early interior cultures entering from the east, (2) early maritime cultures entering from the north, or (3) some combination of the former two. Taking the region as a whole, an increasing body of data suggests that the third alternative is most likely, but the specific nature of such cultural interactions and how they relate to the Washington coast are unknown.

Based upon the limited available data from western Washington, the early prehistory of this area appears much like that described for the Oregon coast and the Columbia River mouth. The PTT currently appears to have been the predominant early culture here; representatives of the FPT and SPT may also have passed this way, but their presence appears much more limited. If the early prehistory of the Washington coast did, in fact, depart from this apparent regional pattern, evidence of this departure has yet to be found.

Given this very limited database, very few observations can be made about the nature of possible Late Pleistocene/Early Holocene settlement and subsistence systems on the Washington coast. In light of regional data, it seems likely that this area was occupied during the Late Pleistocene and Early Holocene, but demonstration of this has yet to occur. It can safely be assumed that the earliest inhabitants of the Washington coast (whenever they arrived) utilized a range of terrestrial and riverine resources. In this regard, if representatives of the PTT were the first on the coast and, if suggestions of their use of marine resources are correct (Matson 1976, 1988; C. Carlson 1979), then these resources may also have been utilized during the early prehistory of the Washington coast. Whatever the extent to which marine resources were used, however, observations about early foraging versus collecting made with reference to the Oregon coast (Section 2.4.4.2) and the Columbia River mouth (Section 2.5.4.2) are equally relevant here.

As such, it is considered likely that the Washington coast was occupied at least intermittently during the Late Pleistocene and/or Early Holocene by cultures which were characterized by forager-type settlement and subsistence systems. Individual human groups were probably small, and marked by a high degree of residential mobility. Architecture and other aspects of their material culture inventories were probably relatively limited. Since food-storage technologies were not employed to any significant degree, hunting, gathering, and other food-producing activities were conducted regularly throughout the year.

2.6.4.3 Late Prehistoric Settlement and Subsistence Systems

All of the available settlement and subsistence data from the Washington coast represents the Late Holocene, but significant uncertainties are apparent here as well. It is clear that the latest (i.e., ethnographic) systems were of the collector type. However, when and how such collector-type adaptations developed and what their relationships to the earlier forager- or collector-type adaptations may have been are completely unknown. In principal, this shift from foraging to collecting should be marked by such attributes as larger sites with evidence of substantial houses, evidence for food storage, evidence of mass harvesting, and a diversification of settlement types. Actual evaluation of the timing and dynamics of the shift is problematic because at this time, there are no data representing cultural activities on the Washington coast older than Early Maritime period materials dating to ca. 2,000-3,000 years ago.

The earliest Early Maritime period materials from the northern Washington coast represent a developed maritime adaptation which made extensive use of marine resources within the context of what appears to be an already established collector-type settlement and subsistence system. The oldest materials from the coast proper are from 45CA201, a large complex of shell midden and non-shell deposits dating between 1,600 to 2,300 years old (Wessen 1984). This site contains abundant evidence of a developed hook-and-line offshore fishery and a strong emphasis on the hunting of fur seals, a pelagic marine mammal. Slightly older materials from nearby 45CA213, on the Strait of Juan de Fuca, also contain many indications of this offshore hook-and-line fishery and evidence of the use of nets (Croes and Blinman 1980). These maritime activities required relatively elaborate technological support and some are fairly described as intensive or mass-harvesting techniques. The elaborate gear, intensive use of resources, and indications of a frequent offshore presence are all consistent with the suggestion that they are associated with a collector- rather than a forager-type system.

The later Prehistoric Northwest Coast period materials from this area, particularly from 45CA24, provide dramatic evidence of the continuation of the same adaptation as a part of what is unquestionably a collector-type settlement and subsistence system. Offshore fishing and pelagic sea mammal hunting are the major economic activities represented at this time; the hunting of whales, possibly also occurring during the preceding Early Maritime period, is at least locally important now. While the oldest demonstrated houses at 45CA24 are only about 450 years old, deeper testing there has revealed an approximately 800-year-old feature which probably represents a house (Mauger 1979:4, 11-13). Elsewhere in this site, undated house floors may be as much as 2,000 years old. All other late sites in the area are also consistent with this view that an essentially ethnographic collector-type land use pattern was in place throughout this period.

As was the case at the Columbia River mouth, this interpretation of late prehistory settlement and subsistence implies that there were no protohistoric/early historic settlement changes analogous to those proposed by Draper (1988) for the southern Oregon coast. Although population reduction over much of the Washington coast may not have been as severe as that along the Columbia River, there is every reason to believe that it was severe (Taylor 1963) and therefore the absence of indications of impact appears remarkable. To some degree, evidence of such impact may be obscured by the extensive use of ethnographic analogy in the interpretation the late prehistoric archaeological record.

In summary, the relatively recent late prehistoric data from the Washington coast appears to reflect a collector-type settlement and subsistence system already in place by 2,000 to 3,000 B.P., and as such provides few insights into the specific details of the appearance of this land use strategy. While the known manifestations may, in fact, represent the first appearance of a logistically based collector-type system, the lack of older Late or Middle Holocene data makes such a view problematic. The current interpretation of these materials suggests that a settlement and subsistence system much like that utilized by the ethnographic groups of the Washington coast may have characterized this area for all of the period actually represented by archaeological materials.

3.0 FORMULATION OF A MODEL PREDICTING THE TEMPORAL AND SPATIAL DISTRIBUTION OF PREHISTORIC SITES ON THE CONTINENTAL SHELF

Any model useful in predicting prehistoric site locations on the continental shelf must answer two basic questions: first, where are sites likely to have occurred when the continental shelf was emergent during the Late Pleistocene and Early Holocene, and second, what locations were protected from the destructive forces associated with rising sea levels to promote site preservation? In this chapter, these two questions are addressed sequentially, and a generalized model suitable for predicting the relative likelihood of prehistoric site occurrence is formulated.

3.1 Expected Associations Between Archaeological Sites and Submerged Landforms

The reconstruction of the expected distribution of cultural remains across the various land features of the coastlines within the study area immediately raises a number of problems and limitations in the database. The major problem, of course, is that our empirical knowledge of offshore cultural resources is negligible, and we are forced to rely on patterns that can be identified for currently terrestrial remains, and extrapolate those patterns to offshore areas. The relationship between observed onshore patterns and hypothetical offshore patterns will receive some scrutiny in the following section.

Other problems lie in the database itself. In the California portion of the study area, 2,376 prehistoric sites were recorded at the time of the records search, while 386 sites were recorded for Oregon and Washington. Predicted site locational patterns based on known site locations are tenuous, however, because the project area has been incompletely surveyed. The lack of recorded sites in a given area by no means indicates that sites are not present as not all areas have been equally surveyed/examined for archaeological resources.

Nevertheless, the past 70 years of archaeological and ethnographic research along the west coast have provided a foundation upon which to base a number of broad generalizations regarding the distribution of archaeological remains over the early Holocene coastal landscape. Summaries of previous archaeological and ethnographic research, and of current thought on settlement and subsistence throughout the prehistoric Holocene, are presented in Section 2.0; the task now at hand is to use that information, and data derived from state site records, to develop some predictions regarding the co-occurrence of archaeological remains and certain landform types.

The following discussion of expected associations between submerged landforms and early Holocene archaeological sites is divided into two sections. The first presents the several classes of data available to us regarding site distribution within the study area: ethnographic data, which offer insight into settlement and site distribution patterning during very late prehistory, and provide important comparative information for interpretation of older remains; archaeological data, which provide locational and distributional information for known sites within the study area; and data on early Holocene and late Pleistocene settlement and land use practices. The second section synthesizes this information, considers current thought on likely adaptive systems in use during the late Pleistocene/early Holocene, and assesses the potential landform associations of offshore archaeological sites.

3.1.1 The Database

3.1.1.1 Ethnographic Data

Examination of the ethnographic summaries presented in Section 2.0 reveals several patterns in site location that are potentially useful in considering early Holocene site distributions. Perhaps most striking is the consistent preference for lagoons and sloughs, where such were available; these provided both protected and highly productive environments, and often were able to support large populations. In California, this preference is noted for the Chumash, the Eastern Miwok, the Patwin, the Coast Miwok, the Wiyot, and the Yurok, all in areas with major estuarine resources. Similar preferences are found for Oregon and Washington groups, particularly in central and northern Oregon.

The association of major ethnographic settlements with rivers and creeks is also very strong. This is particularly true in northern California and Oregon, where large rivers such as the Klamath and Columbia provided not only water but a major subsistence resource focus as well. In central California, many villages are located along stream courses, but this is not uniformly so. Several ethnographers of central California groups report that villages were often situated high above the shoreline, often citing coastal fog as the reason that the coastline and drainages were not selected as village sites. The coastal Pomo, for example, located their villages away from the coastline, on ridgelines near springs; similarly, the Salinan, Esselen, Costanoan, and Yuki are all said to have lived mainly on high ground away from the immediate shoreline.

Nearly all ethnographic groups followed settlement systems featuring movement between large, stable villages and smaller seasonal camps oriented towards specific resources. In most cases, the seasonal campsites are smaller and shallower than the village sites, but sites oriented toward the gathering and processing of shellfish can be quite large and deep. This pattern of movement, typical of a "collecting" strategy as defined by Binford (1980), results in a distribution in which the permanent villages, often located centrally and near a variety of resources, are surrounded (on at least three sides) by a larger number of seasonal camps, which in turn are often associated with a number of task-specific locations.

Locations for each of these types of sites were chosen on the basis of a different set of criteria. Typically, villages were located in favorable areas central to a variety of resources, such as (1) on lagoons or estuaries, (2) on major rivers, or (3) above the fog line near oak trees but within easy access of coastal resources. Seasonal (usually summer) camps were placed in a variety of locations, but since they were often occupied during the best weather and were occupied for shorter periods, they may have been situated in more exposed locations. For example, several groups, including the Pomo, the Costanoan, and the Yuki, situated their permanent villages some distance inland but placed their summer campsites directly on the coast; archaeological evidence suggests such a pattern was followed by the Salinan and Esselen as well. Other groups, such as the Sinkyone, Mattole, and the Salishan speakers of coastal Oregon, established seasonal camps in higher inland settings for acorn collection or terrestrial game hunting. Task-specific locations are usually oriented exclusively for resource extraction and processing rather than habitation. These may be in a wide variety of locales, depending on local resources.

The generalized (and idealized, since many sites served a variety of functions) site types discussed above are in a descending order of predictability with regard to their landform associations. The locations of villages are relatively predictable, since landforms figure prominently in their placement. Often, these landforms (estuaries, lagoons, river drainages) occupy a relatively small part of the total landscape, offering restricted areas in which such sites may occur. Seasonally occupied sites and task-specific locations are found in a wider variety of locations, and were often placed close to desirable resources (oak groves, good hunting areas, productive shellfish beds, pinniped rookeries) rather than favorable landforms. These locations are more difficult to predict based on general landform associations.

3.1.1.2 Archaeological Data

Archaeological data used in the formulation of this model are derived from several sources, including synthetic overviews, the results of various area and site-specific surveys and excavations, and site record information for all recorded archaeological sites within the project area. The site record database offers an abundance of raw data from which a number of potentially significant observations can be made; however, the database from Oregon and Washington, with its total of 386 sites, is somewhat different from California's, with its 2,376 sites. Site record information for California was derived from State of California site record encoding sheets, which do not include information on landform associations; so this information was gleaned in a general way from 1:250,000 scale maps. Detailed landform association information is available for Oregon and Washington, however.

These types of analyses have often suffered from lack of knowledge of strength of association; specifically, these problems derive from (1) failure to associate site density observations with areas actually surveyed and (2) failure to consider the frequency of occurrence of the landforms in question. For example, an observation that most sites are found along open coastline is less meaningful if open coastline is actually the dominant landform within the study area. Nevertheless, the distributional patterns observed over most of the study area are of sufficient magnitude to overcome these limitations. First, while survey bias may have recorded clusters of sites in areas that may not contain higher densities than surrounding areas (Bramlette and Dowdall 1989; Jones et al. 1989; Levulett 1985; Levulett and Hildebrandt 1987), these areas where identified provide useful points of reference for assessments of the sensitivity of unsurveyed areas; in addition, it is believed that at least in central California, the San Francisco Bay, and the southern portion of Northern California, most major coastal sites are known, so that the distribution and landform associations of the most intensively occupied sites can be assessed with reasonable accuracy. Second, it is clear that landforms other than open coast (embayments, creeks and rivers, estuaries, islands) occupy a relatively small proportion of the total coastline, so that any relatively high site occurrence in these areas is probably due to greater intensity of prehistoric use.

With these issues in mind, the archaeological database will be considered below. Due to the database differences noted above, California and Oregon/Washington will be discussed separately.

California: By plotting known sites within the study area on 1:250,000 scale topographic maps, certain correlations of sites or site clusters with specific landform types become visible. Particularly striking, especially along the central coast, is the association of archaeological sites and the mouths of drainages. Sites are found at or near the mouths of virtually every substantial drainage between Morro Bay and the Monterey Peninsula. Although not every site is along a drainage, the correspondence of drainages to sites is most striking, and appears to reflect a genuine preference for such points along the coast. Along the open coast north of Monterey and along the southern north Coast Ranges, the correspondence is somewhat less strong, as a number of drainages are unassociated with recorded sites; still, most drainages are. Further north, the correspondence between drainages and sites becomes still less predictable, with a number of drainages and even some larger rivers such as the Bear and Navarro, lacking recorded sites.

Whether the decreasing strength of correspondence between drainages and site occurrence as one moves north along the coast reflects an actual prehistoric settlement pattern, or is a function of survey bias or site preservation is not known. It may be that northern California populations congregated around the numerous lagoons and estuaries which are more frequent in this region, and this may have rendered drainages less important as resource areas. It may also be that the apparent lateness of initial occupation of the northern California coast provides less of a temporal span of use in the establishment of sites. Perhaps more likely, however, is that the relative inaccessibility of the coastline in northern California has simply allowed numerous sites to go unrecorded, or that the greater frequency and intensity of winter storms in this region have destroyed many sites by wave action and the erosion of river and creek banks.

Bays, estuaries, and sloughs also contain a high frequency of site association. The largest of these within the project area is San Francisco Bay; however, due to the early and extensive historic period development along the bay's margins, specific site distributional data are somewhat sketchy. Nelson (1909) recorded some 425 "shell heaps" in the bay area, most of which were situated on the margins of San Francisco Bay. As discussed in Section 2.0, Nelson noted a differential distribution of sites around the bay, with more sites present in the northern portion than along its southern margins. Available site data corroborate this observation: dense concentrations of sites are found along the east bayshore near present Oakland, Berkeley, and Richmond, and on the west side at the Tiburon Peninsula. Around the southern bayshore, sites are less plentiful but still abundant, with the greatest concentration near present Palo Alto and Fremont. Nelson (1909) had noted that most sites were located within 50 ft of the bay and near the mouths of small freshwater streams, but due to historic period disturbances this is impossible to confirm using existing data.

Along the southern coastal portion of the project area, major estuarine environments are largely absent, with the exception of Elkhorn Slough, located in the center of the coastline of Monterey Bay. Numerous sites are recorded around the slough, with at least two major habitation areas at CA-Mnt-228 and -229. Recent investigations at Mnt-229 (Dietz et al. 1988) revealed a potentially early occupation of the slough environment (see Section 2.0). It should be noted, however, that site associations with this feature prior to about 5,000 B.P. were not with a saltwater estuary, but with a high-energy tidal inlet. After 5,000 B.P. the slough became a brackish lagoon (see Patch and Jones 1984; Dietz et al. 1988).

In northern California, concentrations of sites are also found along the margins of Humboldt and Arcata bays. The known occupation of these areas, as with the rest of the coast of far northern California, seems to have been initiated relatively late in prehistory, after about 1,500 B.P.

It should be noted that, in California, most sites are situated in locations that are difficult to predict based on data available for offshore landforms. Site location maps show numerous sites adjacent to small drainages, on marine terraces away from drainages, and near springs on ridgelines above the coast. For example, inventories of large areas along the coasts of Big Sur (Jones et al. 1989) and the King Range (Levulett 1985; Levulett and Hildebrandt 1987) identified sites, including major habitations, in a variety of settings, including ridgelines, stream terraces, and open coastline. These studies are of some importance to the consideration of coastal site distribution patterns, because they show considerable site densities in steep, rugged terrain away from locations usually considered to be major habitation areas.

Oregon/Washington: The database for Oregon and Washington, with only 386 sites, allows somewhat more detail with regard to landform association. A total of eleven site types are identified for the Oregon and Washington coasts, including shell middens, shell middens with house features, lithic sites, rock art sites, burials, caves, "wet" sites, shell middens with wet sites, culturally modified trees, and caches. Number of occurrences of each of these types is as follows:

Type	No.
Shell Middens	279
Shell Midden w/House Feature	34
Lithic Site	23
Rock Art Site	7
Burial Grounds	9
Cave/Rockshelters	2
Wet Sites	4
Shell Midden w/Burial	19
Shell Midden w/Wet Site	4
Culturally Modified Tree	1
Cache	1
Unspecified	3

These are correlated with seven general landform types, including outer coastal settings, bay/estuary, river/stream mouth, lower river, coastal bluffs, nearbeach lakes, and islands. Site occurrences within these settings are as follows:

Landform	No.
Outer Coast	145
Bay/Estuary	62
River/Stream Mouth	58
Lower River	20
Coastal Bluffs	79
Nearbeach Lakes	7
Islands	8
Unspecified	3

Table III-1 presents a cross-tabulation of site types with landforms for the Oregon/Washington portion of the study area. This tabulation will be useful in assessing the landform associations of known sites in the region. This table indicates that outer coastal areas contain the greatest number of known archaeological sites, with 38 percent of the total site inventory. Coastal bluffs are next with 20.6 percent, followed by bays/estuaries at 16 percent and river/stream mouths at 15 percent. Lower river shores account for 5 percent of the inventory, and nearbeach lakes and islands for about 2 percent each.

The predominance of outer coastal bluff settings may not represent actual preference for these areas, but simply the fact that the outer coast is the dominant landform along this portion of the coast. Indeed, given the relatively low proportion of the landscape occupied by bays, estuaries, and major drainages, a preference for these areas is probably more strongly indicated. It may also be that many of these are shellfish-processing sites rather than habitation sites. It should be noted, however, that 9.6 percent of the outer coastal sites contain house features, which are strong indicators of intensive habitation. Sites associated with bays/estuaries and drainage mouths contain a much lower percentage of these features, but 20 percent of the lower riverine sites do, as do 40 percent of the sites on nearbeach lakes.

Lithic sites, which lack significant fractions of marine shell, are probably, in general, task-specific sites, or single-occupation campsites, since sites occupied with any intensity in this region would be expected to contain shellfish remains. These are found in small numbers in most settings, but are most common along the outer coast.

TABLE III-1

ARCHAEOLOGICAL SITE TYPES AND LANDFORM ASSOCIATIONS, OREGON AND WASHINGTON

Site Type	Outer Coast	Bay/ Estuary	River/Stream Mouth	Lower River	Coastal Bluffs	Nearbeach Lakes	Islands
Shell Midden	100	47	46	11	62	4	6
Shell Midden w/House Features	14	1	4	4	7	2	0
Lithic Site	14	2	1	3	2	1	0
Rock Art	7	0	0	0	0	0	0
Burial Ground	2	2	2	0	3	0	0
Cave/Rockshelter	1	0	0	0	1	0	0
Wet Site	0	3	0	1	0	0	0
Shell Midden w/Burials	4	4	5	1	4	0	2
Shell Midden/ Wet Site	1	3	0	0	0	0	0
Culturally Modified Tree	1	0	0	0	0	0	0
Cache	1	0	0	0	0	0	0
TOTAL	145	62	58	20	79	7	8

Other site types, such as burial grounds, caches, rock art sites, and culturally modified trees, are probably special-purpose sites whose locations are not predictable based on generalized landforms.

Using these data, and taking into account the previously discussed cautions regarding survey bias and strength of association between sites and landforms, certain tenuous conclusions may be derived. Evidence of intensive habitation may be found in all settings, but the available site landform association data suggest that protected and productive environments such as embayments, estuaries, and nearbeach lakes are likely to contain high densities of archaeological sites; also likely to contain sites are lower river courses and river and stream mouths, which also provided protected environments, as well as fresh water, fish, and other resources. Outer coastal areas and coastal bluffs, being more extensive, may contain relatively high numbers of sites, but site densities will be lower in general.

3.1.1.3 Landform Associations of Early Holocene Remains

In the southern portion of the project area, south of the Point Arena/Clear Lake areas, early remains are most often associated with lakes, lagoons, embayments, and marshy creeks; examples include Rancho Park North near San Diego, SCr-177 near Santa Cruz, possible early components at Diablo Canyon and Elkhorn Slough, an isolated find at Bodega Head, and, further inland, early finds at Tulare Lake, Clear Lake, and Laguna de Santa Rosa. These associations have led some researchers to suggest a possible PCT, seen as a coastal manifestation of the better-documented but still poorly known WPLT (Moratto 1984).

In northern California and most of Oregon, such an association is less clear, due largely to the near absence of known early Holocene remains along the coast. In California, such remains are limited to a single fluted projectile point found near present Caspar, on what during the late Pleistocene and early Holocene was a broad coastal terrace (Simons et al. 1985). In Oregon, a single fluted point is reported near Siltcoos Lake on the central coast (Minor 1985). A somewhat later component at 35DO130 (Minor and Toepel 1986), dated to ca. 8,000 B.P., was located along an estuary and offers data important to the present discussion (see below).

The situation in northwest Oregon and Washington is similarly unclear. Potential early assemblages near the Columbia River mouth (Minor 1984) have been suggested to represent either a Paleo-Indian or early Archaic occupation, but are as yet undated. In Washington, no coastal evidence of Bergland's (1983) Early Prehistoric Period (12,000 to 6,000 B.P.) is known, although an apparently butchered mastodon has been found on the Olympic Peninsula and isolated fluted points have been recovered from the Puget Sound Basin. Carlson (1983) suggests that bearers of the PTT may have arrived on the northwest coast 12,000 years ago and that these peoples may already have regularly exploited marine resources as well as terrestrial ones. If so, seasonal residential base camps along the coastal zone (now inundated) would be expected.

It is clear from the above discussion that although somewhat more information regarding the landform associations of late Pleistocene/early Holocene sites is available from central California, the general sparseness of early materials throughout the coast makes any such assessment difficult and speculative. In southern and central California, the earliest coastal components seem to be associated with estuaries (Rancho Park North and possibly Elkhorn Slough), embayments (Diablo Canyon, SLO-801 near Pismo Beach, and possibly Bodega Head), and the Santa Barbara Channel Islands. Other early Holocene components are found slightly inland, near marshy creeks or springs (SLO-177, SLO-832, and SLO-877), or, in the case of SCr-177, possibly near a lake. In Oregon and Washington, an undated but apparently early assemblage (the Youngs River Complex) is found in a riverine setting well inland, and an 8,000-year-old component (Component I at 35DO130) is found at what was at that time an estuary.

To summarize, it seems that early components along the west coast are situated either near embayments or estuaries, or in inland settings near creeks, springs, or lakes; evidence is lacking for occupation of outer coastal areas, although those areas may have seen some use. Clearly, though, the available sample is very small, and may be affected by differential preservation. A synthetic consideration of recent thought on hunter-gatherer subsistence ecology, and of ethnographic and more recent archaeological data discussed above, will help to provide a more confident set of expectations regarding the landform associations of late Pleistocene/early Holocene coastal sites.

3.1.2 Synthesis

Leaving aside for the moment the poorly known late Pleistocene/early Holocene assemblages, a review of the available archaeological and ethnographic data suggests several trends in prehistoric land use over the past 8,000 years, trends that have implications for expected landform settings for early sites. We have seen in Section 2.0 that along the central California coast, use of marine resources is established very early on, with a well-developed maritime economy established by about 5,500 B.P. Coastal components dating to between about 5,500 and 3,700 B.P. seem to indicate a high level of residential mobility by groups inhabiting favorable spots along the immediate coastline, primarily protected bays and estuaries near fresh water and abundant resources. A shift in locational patterning becomes evident around 3,700 B.P., with the appearance of a number of inland sites, with many coastal sites continuing to be occupied. Around 1,000 B.P., residential sites along the coast appear to have been abandoned, to be replaced by large shellfish-processing sites and small, temporary camps; inland, large, permanent villages appear. This pattern is consistent with the observed ethnographic settlement patterning of the Costanoan, Salinan, Esselen, and probably the northern Chumash.

Evidence from northern California, however, suggests that initial occupation of the coast took place relatively late, with the earliest known component (Pt. St. George I) dated to about 2,200 B.P. The interior North Coast Ranges, by contrast, are known to have been occupied several thousand years earlier. It should be noted, however, that the lack of evidence for early occupation of the northern California coast may be due to a number of factors, including the differential preservation of site contexts, fewer archaeological investigations, or inundation of earlier sites. This latter possibility is raised by a review of the paleo-landform maps of the continental shelf study area, which show that ancient shorelines in northern California were considerably further seaward of the present shoreline than are those of central California. The greater inundation area off northern California may have resulted in the flooding of a larger proportion of early sites.

Nevertheless, the complete lack of known components predating 2,200 B.P. is compelling evidence that coastal northern California was not extensively occupied until relatively late in prehistory. This finds some support in Levulett's (1985) work along the King Range, which indicated that the earliest coastal sites represented primarily terrestrial orientations, while later sites contained evidence of increasing use of marine resources.

Data from Oregon suggest that marine resources were being exploited ca. 8,000 B.P., with subsequent intensification of marine resource use, particularly shellfish, along with an accompanying shift at some point from a foraging to collecting strategy. As discussed in Section 2.0, some researchers see the late prehistoric situation in coastal Oregon as one of higher populations than those observed ethnographically, along with low residential mobility. Finally, in Washington, initial occupation appears to have been late, with essentially the ethnographically observed pattern followed for the duration of the prehistoric period.

What does this mean with regard to late Pleistocene/early Holocene site distribution? As we have seen from central California and Oregon, marine resources were exploited, and coastal settings occupied, by ca. 8,000 to 9,000 B.P., near the end of the rapid sea level rise associated with the Holocene Transgression. Faunal remains from these sites commonly include abundant remains of numerous species of fish and shellfish, indicating a strong reliance on these resources. Moreover, some assemblages dating to this period, particularly from sites on the Santa Barbara Channel Islands (Orr 1967; Hoover 1971; King 1981) contain faunal remains and artifacts that indicate considerable sophistication in the exploitation of marine resources.

The possible origins of these early maritime adaptations have implications for the distributions of late Pleistocene/early Holocene remains over the landscape. As discussed in Section 2.0, some researchers see early coastal adaptations (the PCT) as a manifestation or extension of the lacustrine oriented WPLT, which in turn derived from the specialized big game hunting adaptation of the FPT with the climatic changes associated with the early Holocene (Moratto 1984). Although sites identified with the PCT are most common in southern and central California, the model may be applied to northern areas as well. If this model is correct, development of marine adaptations should have occurred well after the initial Paleo-Indian occupation of terrestrial areas (Jones 1990), and after much of the sea level rise associated with the Holocene Transgression. Occupation of the outer continental shelf would be characterized by small, highly mobile foraging groups, with little reoccupation of campsites. Remains associated with such an adaptation would be characteristic of extreme foragers, and consist mainly of isolated artifacts or small, sparse lithic scatters. Although the hunting of big game may have been a major pursuit, there is little evidence that it was the exclusive focus (Moratto 1984:81), and the economy may well have been somewhat diversified; thus campsites would be expected in a variety of locations in both the coastal plain and upland areas.

It may well be that early developments along the coast are more complex, and that the potentially high value of marine resources stimulated their early exploitation. This complexity is alluded to in Moratto's (1984) review of Pleistocene/early Holocene developments, which acknowledges that the association of fluted points and purported WPLT materials may indicate the traditions are related and perhaps contemporaneous; and that the PCT may yet prove to be simply a "variant" of the WPLT. The evidence of sophisticated marine adaptations by ca. 8,000 B.P. suggests that coastal adaptations may have been in place, at least in certain areas, well prior to that time. On the Channel Islands, for example, sites dating to King's (1981) Phase Ex of the Early Period (8,800 to 7,270 B.P.) contain bone gorges and parts of compound fishhooks, as well as the bones of small teleosts, swordfish, and large sharks. Harpoons may also have been used. Such fishing implements may also have been used on the mainland during Phase Ex times but have not been found due to pedoturbation (Glassow and Wilcoxon 1988). Jones (1990) has suggested that marine environments may have offered concentrated and easily obtainable resources that would have been highly valuable in terms of optimization principles, resource value, and division of labor, making them attractive environments for early exploitation.

The development of prehistoric economies focused on marine resources may also relate to environmental changes attending the slowing of sea level rise after that time. One of the major changes associated with this slowing may have been the maturation of estuaries. Bickel (1978:8) points out that highly productive estuaries are relatively uncommon throughout the Earth's history, forming only during periods of sea level rise. Once relatively stable levels are reached, estuarine environments stabilize, becoming highly productive due to chemical changes associated with the contact of fresh and salt water (Bickel 1978). In addition to the formation of productive estuarine environments, the stabilization of sea levels may have allowed increased offshore sedimentation in certain areas, encouraging the formation of shellfish beds (Yesner 1983), and may also have allowed the establishment of anadromous fish runs (Fladmark 1983).

It is also suggested by some researchers that extensive reductions in the extent of coastal plains in some areas may have reduced the productivity of certain terrestrial environments, causing early populations to diversify their subsistence base (Erlandsen 1987; Glassow et al. 1988). This diversification may have included increased use of marine habitats.

As we have seen from Section 2.0, most archaeological evidence supports a transition, at perhaps various times throughout the study area, from a foraging strategy to a collecting strategy. Early occupants of the continental shelf, then, are seen as foragers, while ethnographically observed patterns are almost exclusively those of collectors. While this appears to be true in broad form, and may have affected observed site locational patterns, the nature of the coastal resource base seems to have encouraged considerable reoccupation of sites by residentially mobile groups. The result is that earlier forager sites along the coast are often deep, dense middens that are difficult to distinguish from collector residential bases. CA-Mnt-229 on Elkhorn Slough is an example of such a site, interpreted as a forager residential site (Dietz et al. 1988) but with over 150 cm of midden development and a wide range of faunal and artifactual remains, as well as at least 10 burials.

3.1.2.1 Expected Landform Associations

The above discussion offers some basis for the development of predictions regarding the landform associations of late Pleistocene/early Holocene sites on the now submerged portion of the continental shelf. First, since it seems likely that marine adaptations were well in place prior to the final phase of the Holocene Transgression, submerged sites are expected along the margins of former embayments, estuaries, and drainage systems, areas with access to both fresh water and the greatest abundance and variety of resources. Islands, too, were occupied relatively early near the project area, and now-submerged former islands may well contain evidence of occupation. Evidence of this pattern is strongest in central California, although early estuarine and riverine adaptations are found in Oregon as well. Northern California and Washington are more problematic, since evidence is lacking for any substantial early occupation; indeed, the data from northern California suggest a movement from a terrestrial to a marine focus relatively late in prehistory. Nevertheless, this does not exclude the possibility of an early marine adaptation, and may be due to differential site preservation. Given the patterns observed from the north and south, there is considerable possibility that offshore areas were occupied. It may also be profitable to review the extent of shoreline changes in various portions of the study area when considering the first appearances of human occupation. The width of the area inundated after 18,000 B.P. tends to progressively narrow from the northern portion of the study area to the southern portion. Widths of this area off the coast of Oregon and Washington often exceed 20 to 30 km, and 15 to 20 km off northern California; off central California, however, the width of this area averages less than 10 km. The lack of late Pleistocene/early Holocene remains in the northern portion of the study area, then, may be partially due to the larger inundation area.

The apparent blurring between foraging and collecting systems within the project area suggests that field camps occupied by logistical task groups, or task-specific locations may be present in submerged areas as well. These may include hunting camps, shellfish processing locations, or other sites in a variety of locations, similar to those found in the ethnographically observed settlement systems. It is expected, however, based on the trends discussed above, that such sites would be relatively few, and that most activities would be carried out at the residential camps, located on embayments, estuaries, drainage systems, or islands.

3.2 Factors Affecting the Preservation of Submerged Prehistoric Sites

The distribution of prehistoric sites on the continental shelf is dependent upon at least three factors: 1) the distribution of sites over the paleo-landscape; 2) the preservation potential of sites prior to inundation; and 3) the effects of inundation upon sites. Likely relationships between prehistoric sites and paleo-landforms were discussed in the previous section. The following discussion focuses on preservation factors and destructive processes active within the terrestrial and marine environments.

3.2.1 The Terrestrial Setting

All cultural materials present on the continental shelf have been derived through one means or another, from terrestrial sources, whether through inundation of terrestrial sites, further inundation of intertidal cultural features (e.g., fish traps and canoe runs) that were associated with terrestrial sites, or direct deposition of artifacts into a subtidal setting through the loss of waterborn cargo or watercraft. Terrestrial sites that have been inundated may be much more numerous than sites that were originally deposited intertidally or subtidally, and, by their sheer numbers and nature, inundated terrestrial sites offer the greatest potential for significant cultural discoveries.

The entire range of terrestrial site types that has existed prior to 3,000 B.P., when sea level reached its approximate modern extent, has been inundated on the continental shelf. This is not to say that every inundated site has survived to the present time. The vast majority, in fact, have likely been destroyed by wave-induced erosion as sea level rose over them (post-inundation preservative and destructive processes are discussed in subsequent sections).

In order for a site to survive on the continental shelf, it must first have survived long enough subaerially for the sea to cover it. Terrestrial cultural deposits are subject to a wide variety of post-depositional disturbances. Sites located in riverine settings are subject to destruction due to cutbank erosion associated with meandering stream channels. Sites located in non-depositional environments are subject to surface erosion. Buried sites have the best potential for surviving relatively intact. Even then, chemical weathering can significantly affect the preservation of organic materials in the site. Soil disturbances (pedoturbation) can significantly affect the integrity of cultural deposits. Typical examples of site pedoturbation processes include rodent burrowing, tree falls, mass soil wasting, frost heaving, and differential drying of soil. It is clear, then, that there may have been significant loss of cultural materials and/or disturbance to cultural deposits prior to the onset of inundation.

3.2.2 The Intertidal Setting

The intertidal zone is that area where wave energy interacts with bottom sediments. It is the area of the continental shelf where archaeological sites are most likely to be impacted or destroyed by erosion as sea level rises.

Opinion is divided as to the effects of inundation and waves on archaeological sites, but there is a general consensus that many prehistoric sites are likely to have survived the inundation process in a relatively intact state. For example, Kraft et al. (1983:116) concluded that "...the possibility of eventual discovery of sites [on the continental shelf] is high." Their position is supported, although qualified somewhat, by Inman.

> ...the probability of recovering evidence of habitation representative of times of rapid sea level change is not high. Still-stands in sea level, on the other had, lead to a stability of terrace formation and coastal form that favors the concentration and permanency of cultural deposits... During still-stands...lagoons and ecological zones are established, and become stabilized, supplying resources of interest to early peoples... As a consequence, the identification of shorelines associated with still-stands in sea level is the most logical first step in the process of locating areas of human activity on the shelf (Inman 1983:39-40).

Although paleo-shorelines associated with still-stands would seem to be likely areas for both the occurrence and preservation of prehistoric sites, Masters cautions that still-stands are the most destructive period for sites occurring in an exposed beach context. Nevertheless, "...the evidence suggests that some prehistoric sites along the southern California coast may be expected to survive a marine transgression relatively intact" (Masters 1983:211).

Wave energy, undoubtedly, has significantly affected the majority of inundated prehistoric sites, however, the destructive potential of waves varies greatly with physiographic setting. Flemming (1983) ranked various coastal landforms regarding the preservation potential which they afford offer to archaeological sites during the inundation process and discussed known examples of submerged sites preserved in such settings. Citing evidence of "..lithic and Bronze Age (3rd-2nd millenium) sites...found from the surf zone down to 25 m..." (1983:135), Flemming concluded that:

> Lithic site structures and artifacts, uncemented walls, burials, hearths, middens, food remains, and tools and other artifacts can survive in stratigraphic context in the sea or below the coastal groundwater table after a marine transgression... Such remains are protected either because the environment is low energy (ria, lagoon, estuary, karstic cave, archipelago), or because the beach gradient provides a protective cover of sediment (Flemming 1983:166).

In general, the same classes of physiographic locations that have a high potential for site preservation on land offer the highest potential for preservation during and following the process of inundation. For example, sites that are buried by a protective covering of sediments are much less likely to be impacted by wave erosion during inundation than are exposed sites. There have, in fact, been a number of studies which have examined the effects of inundation within man-made reservoirs (e.g., Garrison 1975; Lenihan et al. 1977), but these address areas subject to far less wave energy than the present study.

At least three factors affect the degree of wave erosion likely to impact a site: burial prior to inundation, the duration of exposure in the intertidal zone, and the intensity of wave energy. Burial of terrestrial sites is one of the best mechanisms for increasing the chances of survival during inundation. Sites that are most likely to become buried in a terrestrial setting occur in alluvial environments such as river floodplains and terraces. As a result, submerged riverine meander belts have been judged to be one of the most likely settings to contain preserved prehistoric sites on the continental shelf. Little data is available on the minimum depth of overburden necessary to protect cultural materials, and this value may vary depending upon the type of overburden sediment involved and especially upon the gradient of the bottom. Flemming (1983:144) suggests, however, that as little as 1 to 2 m of sand may be sufficient to protect inorganic cultural materials on an otherwise exposed high wave energy beach.

Duration of exposure in the intertidal zone is affected by the rate of sea level rise and by the gradient of the coastal plain. When the rate of sea level rise is relatively fast, the intertidal zone transgresses at a relatively rapid rate and the duration of exposure of particular sites to intense wave energy is correspondingly brief. Brief, in this context, may be on the order of hundreds of years. The gradient of the coastal plain has a much greater impact on the rate of transgression than does the rate of sea level rise. Where the coastal plain gradient is relatively steep, changes in sea level would produce relatively slow horizontal shifts in the position of the intertidal zone. Where the gradient is minimal, as is the case for most of the continental shelf (former coastal plain) in the study area, the same changes in sea level would result in rapid horizontal changes in the position of the intertidal zone. The gradient of the seafloor in San Francisco Bay is so gentle, for example, that the shoreline is estimated to have migrated as far as 30 m per year during the initial transgession of the sea through the Golden Gate sometime following 10,000 B.P. (see Volume II).

The role of seismic events in altering the duration of intertidal exposure may be important on a local scale. Subduction earthquakes periodically occur along much of the Pacific margin of North America. These events can result in abrupt dramatic changes in relative sea level. For example, at the head of Cook Inlet in Alaska, an earthquake in 1964 resulted in a total vertical displacement of approximately 2.4 m. Atwater (1987) reports evidence for Holocene subduction earthquakes with displacements of greater than 1 m along the Washington coast. Clearly, events of this type have considerable potential to rapidly move fixed points on the continental shelf into or out of the active intertidal setting. The seaward side of vertically displaced faults may offer a unique preservation environment, in that inhabited sites may have been rapidly inundated to a level below the most detrimental effects of waves.

Wave intensity is affected by the relative exposure of the coastline to the large waves of the open sea and by the gradient of the inner continental shelf. As one measure of this condition, Flemming (1983) utilizes the nautical term "fetch" which refers to the distance of unobstructed surface over which a prevailing wind blows. Hence, sites with a short fetch are subjected to less wave energy than sites with a long fetch. Sites occurring on the shoreline of bays, estuaries (associated with river mouths), on the mainland side of lagoons (associated with barrier islands), or in caves or sinkholes are offered the most protection from the destructive effects of waves. Sites located on the lee side of islands and headlands are likewise afforded a relatively high degree of protection from wave erosion.

> Optimum preservation of artifacts occurs in submerged karstic caves, sinkholes, and estuarine lagoonal or peat deposits. However, where an equilibrium sand beach exists, unconsolidated remains can be preserved *in situ* under a meter or so of sand even in highly exposed positions (Flemming 1983:136).

Bays, estuaries, lagoons, and other protected water bodies occur in a wide variety of forms and offer a considerable range of wave energy regimes. Further, they include some very large features and therefore provide extensive areas capable of protecting cultural deposits during inundation. Among the most sheltered are bays and lagoons situated behind coastal bars and nearshore barrier islands and the upper reaches of estuaries and rias. While large open bays may be subject to relatively high wave energy, these levels are still considerably lower than those associated with exposed shoreline areas. Within the study area, large sheltered water bodies such as San Francisco Bay, Willapa Bay, and Grays Harbor have considerable potential to protect cultural deposits during inundation. As discussed above, the meander belts illustrated on the prehistoric site predictive zone maps in Volume V are the most likely areas to have contained both the protected waters offered by estuaries and sites that were buried prior to inundation.

Earlier in this study (see Volume II) the possibility was discussed that the study area may have contained an extensive barrier island system with associated lagoons prior to about 10,000 B.P., especially in the northern portion of the study area. Seaward of the 10,000 B.P. shoreline, the study area has a very gentle gradient reminiscent of the Texas coastal plain. The likely abundance of sand on the continental shelf during that period, from sources such as the Columbia River, suggests a possible analog with the barrier island system along the Texas coast. One effect of a barrier island is that storm waves from the open sea are dissipated by the island, providing a relatively sheltered wave environment in the lagoon behind the island. While erosion still occurs on the shores of such a lagoon, the possibility of burial prior to inundation is increased by the abundance of sediment and the low coastal gradient. The possibility for burial of sites remains highest within stream meander belts, even in a barrier island/lagoon setting. Along the Texas coast, for example, flooding of low gradient meandering rivers, such as the Rio Grande, has caused frequent rapid changes in the river channel. Even within early historic times, sections of the river have been isolated by several miles from the main river channel due to shifts occurring during a single flood event. Sites buried near the main river channel by heavy overbank sedimentation, once cut off from the river, are no longer threatened by active cutbank erosion, yet they continue to accumulate windblown and waterborn sediment.

Caves and sinkholes represent a second class of landforms which, when situated in coastal areas, may be characterized by reduced wave energy during inundation. As compared to the protected water bodies noted above, however, this class is somewhat less variable and the individual features are likely to be much smaller in size. In considering caves as features with a potential to harbor intact inundated cultural deposits, it is worthwhile to distinguish between sea caves and karstic or solution caves. The former are created by the action of waves thus, while often attractive for human occupation while emergent, it is reasonable to expect that they would again be exposed to relatively high wave energy when undergoing repeated inundation. In contrast, the formation of karstic caves is unrelated to the action of waves, rather they form in limestone rich areas with low wave energy. Sinkholes represent another type of karstic feature which may offer a low wave energy environment. While large sinkholes have been known to be utilized as water sources or as animal traps by prehistoric populations, the primary habitation area would not generally occur inside the sinkhole where the highest protection from waves is afforded. Limestone-rich areas are quite limited within the study area, thus sea caves may be the principal feature of interest in this class. In this regard, data collected by Maloney (1965) indicates that much of the midshelf and shelf-edge areas off the central Oregon coast are composed of upper Miocene and Pliocene sedimentary rocks which could favor the formation of sea caves.

Islands represent a third class of landforms which may offer low wave energy localities capable of protecting cultural deposits during inundation. At least two such low wave energy locations may be identified: in the lee of an island and within island archipelagoes. While the extent of such areas is a direct function of the size of the islands with which they are associated with, in most cases, these areas will not be large. Probably most common, the lee side of islands, particularly nearshore islands, are likely to be sheltered areas marked by relatively low wave energy regimes. The interior of island archipelago systems have a similarly low wave energy regime except that the low wave energy occurs between the islands rather than between an island and the mainland. Within the study area, islands are relatively uncommon; however, the Farallons off the California coast and unnamed mid-Holocene islands off the Oregon coast may have provided protected settings of this type.

This discussion suggests that open exposed shorelines have only a very limited potential to protect cultural deposits during inundation, and while this is generally so, there can be important exceptions. For example, the energy of waves tends to be dissipated by the gently sloping bottoms common on the continental shelf of the study area. Waves tend to strike the shore with greater force along steep bottoms, thus having greater erosional effect, than along level bottoms. Within the study area, the continental shelf gradients tend to be minimal thus, although the horizontal extent of the intertidal zone might have been greater during transgression than along steeper shores, a relatively low energy regime within that intertidal environment is suggested. Even exposed high wave energy beaches may have some potential to protect cultural deposits if the materials are buried at sufficient depth and the sediment transport regime is either at equilibrium or accumulating.

3.2.3 The Subtidal Setting

The subtidal zone includes all of the seafloor below the normal reach of high wave energy, and thus offers a mechanically stable environment for inundated sites. All of the continental shelf within the study area is located within the subtidal zone. As sea level rose, the intertidal zone migrated landward, leaving behind a basal transgressive sand layer in the subtidal zone. Once having "arrived" in the subtidal zone, buried sites would be relatively safe from additional mechanical degradation. As is true of sites in the intertidal zone, burial beneath sediments prior to inundation would play a significant factor in the survival of sites in the subtidal zone. A considerable number and variety of prehistoric sites undoubtedly would have survived the transition from terrestrial to subtidal setting.

Sites that have survived inundation should not necessarily be expected to be any more "pristine" than most terrestrial sites. Conversely once a site is inundated, most of the detrimental effects common to terrestrial sites, as discussed above, cease to be a factor. If the site survives inundation fairly intact, therefore, it will probably be better protected underwater than a contemporary site onshore, particularly if it survived inundation due to burial beneath a heavy overburden. For example, a terrace site that has been buried by sufficient alluvium may survive inundation due to its protective soil cover. Once the terrace is inundated, the adjacent stream no longer meanders and cutbank erosion ceases. At the very least, inundated sites will have been spared the depradations of decades of collectors and pothunters.

Since the approximate establishment of modern sea level about 3,000 B.P., the sea has continued to rework unconsolidated Pleistocene sediments, as well as finer silts and clays delivered by terrestrial fluvial processes. The Holocene Facies Model, discussed in Volume II, has resulted from this process. Depending upon their proximity to coastal river sediment sources, Holocene sedimentary units overlying outer shelf relict facies may range in thickness from less than 10 m to greater than 50 m. Potentially culture-bearing deposits may occur beneath more recent Holocene sediments at any location on the continental shelf where submarine sediments have been deposited, although the potential for intact archaeological sites greatly increases in areas designated on the predictive zone maps (Volume V) as containing sensitive landforms.

3.3 Discussion of the Predictive Zone Maps for Prehistoric Archaeological Resources in the MMS Continental Shelf Study Area

Information and insights obtained from review of the available archaeological and geological data constitute the basis for our preparation of specific predictive zone maps for the study area. Central to this effort was the development of a sensitivity matrix which would establish the character of individual zones. Once such "definitions" were established, they were used as measures in order to describe the distribution of predicted relative potentials for site loci within each subarea.

3.3.1 The Sensitivity Matrix

The sensitivity matrix represents the principal mechanism for assessing the relative potential for the presence of archaeological resources. Thus, the matrix is the point for practical articulation of the available archaeological and geological data. Unfortunately, however, these databases are limited and uneven over much of the study area. Thus, the model which is oriented largely toward geomorphic features. In this regard, note that the model employed assumes similar site distribution patterns over the entire spatial and temporal range of the study area. While this was not entirely the case, we believe the available data demonstrate that certain site types cluster around readily recognizable landforms, despite varying settlement and subsistence systems. The available data, given the scale of the effort, do not support more detailed subdivisions.

The sensitivity matrix employed in this study is a two-dimensional matrix factoring temporal periods against isopach data and a range of selected landform associations, to the extent that they are detectable in the existing 1:250,000 scale maps (see Table III-2). Individual cells of the matrix consist of either an area with no Quaternary sediments of a particular landform association, or a particular age range.

The vertical axis of the sensitivity matrix represents a series of temporal periods indicated by arabic numerals; note that they include three brief periods (18,000 to 15,000, 15,000 to 10,000, and 10,000 to 7,500 B.P.) when sea level changed relatively rapidly, bracketed by two longer periods when conditions were more stable. It is difficult to put a precise measure on the changes in relative potential between one temporal cell and another, but a few generalizations can be made. There is a gradient of potential which reflects this temporal gradient. Thus, currently there are no data to argue for the presence of humans in the study area prior to ca. 18,000 years ago; consequently the potential of areas representing this period is particularly low. Assuming increasing human population levels over time, the potential for the existence of prehistoric archaeological resources increases as well.

The horizontal axis of the sensitivity matrix contains several columns which represent geomorphic factors thought to influence the potential for the presence of archaeological resources. The various categories are heterogeneous, and not necessarily mutually exclusive. They include: absence of Quaternary sediments, non-sensitive landforms, paleoembayments, submarine channel systems, and island complexes. Of these, the first is only indirectly a geomorphic condition. In fact, a variety of dynamics influence the deposition of Quaternary sediments on the outer continental shelf, but one thing is clear: intact archaeological resources can only be present in places where Quaternary sediments exist. Those areas which lack Quaternary sediments, regardless of age or landform, have virtually no potential to contain such resources.

With respect to landscape features themselves, three relatively higher potential landscape associations have been identified: Paleoembayments, Submerged River Valley Systems, and Island Complexes. All other landscapes have been "lumped" together into a single Non-

TABLE III-2

A SENSITIVITY MATRIX FOR PREHISTORIC ARCHAEOLOGICAL PREDICTIVE ZONE MAPS

Period (Years B.P.)	Landforms[*]				
	NS	NSL	PEB	SCS	ICX
>18,000	1a	1b	1c	1d	1e
18,000-15,000	2a	2b	2c	2d	2e
15,000-10,000	3a	3b	3c	3d	3e
10,000-7,500	4a	4b	4c	4d	4e
<7,500	5a	5b	5c	5d	5e

[*] Landform abbreviations: NS - No Sediment (any landform); NSL - Non-Sensitive Landforms; PEB - Paleo-embayments; SCS - Submarine Channel Systems; ICX - Island Complexes

Sensitive Landforms category. As was the case with cultural variation, the decision to "lump" all other landscape features reflects what can be discriminated from the available data at 1:250,000 scale, rather than any belief that no other features are potentially of interest. While all three of the associations are considered to have greater potential than the non-sensitive landforms, there is little basis to rank relative individual potentials either within or among the associations. While it might appear that the potential of Island Complexes is directly related to the existence of maritime cultures capable of occupying them, this is not actually the case. In fact, such landforms may also have been occupied, prior to inundation, when they existed in the form of coastal highlands.

Paleo-embayments include a range of coastal features wherein local landforms created bodies of marine water which were, at least partially, protected from the energy of ocean waves and winds. For the most part, these are either large protected estuaries where terrestrial rivers meet the coast or they are bights formed in association with rocky headlands or the growth of coastal spits. Such habitats were probably attractive for human occupation, and their relatively low wave-energy regimes probably favored the preservation of possible cultural deposits during inundation. Lagoons associated with barrier island complexes present another protective environment which may have been widespread from 18,000 to 10,000 B.P., however, the existence of such features is problematic.

Submerged River Valley Systems are a class of potentially sensitive landforms. As the lowermost portions of terrestrial river systems, they have some overlap with the previous group. This group is more diverse than the former, however, and it may include a wide range of lower river channel and near-channel features not represented in paleoembayments. Submerged River Valley Systems also would have been attractive for occupation and they offer considerable potential to protect evidence of such occupation during subsequent inundation.

The last class of potentially sensitive landforms, Island Complexes, is somewhat different from the previous two. Rather than addressing a continental setting, this class represents coastal islands. The group is referred to as a complex because it includes at least two areas associated with each island: the terrestrial surface actually exposed at any particular point in time, and nearshore submerged areas in the lee of the exposed terrestrial surface. This landscape association also may have significant potential to contain and preserve intact archaeological resources.

3.3.2 *The Predictive Zones of the Study Area Subareas*

The sensitivity matrix described in the preceding section was utilized as the basis for defining predictive zones. Isopach and paleo-landform maps of each subarea were overlain, and then zone boundaries were drawn in order to meet individual matrix cell definitions. The resulting prehistoric archaeology predictive zone maps (Volume V) are summarized below, by subarea.

3.3.2.1 Central California

The predictive zone map for central California covers a narrow offshore strip extending from Morro Bay on the south to San Francisco Bay entrance on the north. From Morro Bay north to about Cape San Martin near present Gorda, the continental shelf varies between about 5 and 13 km in width; however, from this point north to San Francisco Bay, considerable variation is seen, from a maximum of about 45 km near San Francisco Bay to a minimum of about 2 km off the present shoreline of Carmel Bay. To the south, the shelf off of present Big Sur mirrors the steepness of the present shoreline, being consistently less than 10 km in width.

The sensitivity cells within the predictive zone are defined on the basis of the five identified Holocene shoreline intervals and various physiographic features (see Section 3.1). Note that the band representing the interval between ca. 7,500 B.P. and the present (numeric code 5) is much narrower than the previous intervals, indicating generally less transgression during that time.

Most of the central California study area consists of non-sensitive landforms covered by Holocene sediments (letter code b). This mantle, consisting of fluvial and shoreface sediments transported offshore during and after the Holocene Transgression, is fairly thin (generally less than 10 m) over most of the central California study area, while deep sediments of up to 60 m are found off Monterey Bay. Shoreward of the 10,000 B.P. shoreline, and particularly of the 7,500 B.P. shoreline, many of these sediments have been removed by wave or current action, leaving exposures of pre-Pleistocene rock (letter code a). Shoreward of the 7,500 B.P. shoreline, these exposures account for roughly 80 percent of the central California study area.

Several submarine channel systems are identified on the continental shelf within the central California study area. These represent Quaternary fluvial systems and are likely locations for rivers and streams, estuaries, and lakes; these would probably have contained relatively highly productive environments, and may have attracted human populations. South of Point Sur, eight submerged river systems are identified within the study area; while some are essentially continuations of modern terrestrial drainage systems, such as the drainage system offshore of the mouth of the Big Sur River, some are unassociated with any major modern drainages. A complex system of submerged rivers is found off present Monterey Bay, crossing the Holocene shorelines seaward of the present Carmel River and of the former outlet of the Salinas River.

Several former islands associated with earlier Holocene sea level stands are identified in the central California study area. All of these were small, apparently measuring less than about 2 km in length, and are most commonly found seaward of the 10,000 B.P. shoreline.

Relatively few embayments are found along early Holocene shorelines in this steep, rocky portion of the California coast. The major exceptions are the large coastal indentations offshore of present Monterey Bay; however, due to the large size of the bay--a maximum of about 40 km north to south--little protection from wind and ocean swells is offered except in its extreme northern extent, around the 7,500 B.P. shoreline off of present Capitola. Most of the other identified paleo-embayments are associated with submarine channel systems (see the embayment at Pacific Grove), or are not mantled by sediments, and thus not afforded increased sensitivity. Potentially sensitive paleo-embayments are found between the 10,000 and 7,500 B.P. shorelines near present San Simeon, and shoreward of the 18,000 B.P. shoreline near the present mouth of the Big Sur River.

3.3.2.2 San Francisco Bay

This portion of the study area includes the area now occupied by the San Francisco Bay, an extensive bay and wetland system that extends from the Golden Gate eastward to the western Sacramento Valley, and with a north-south extent of about 50 miles. The bay was formed during the latter portion of the Holocene, when rising sea levels entered the Golden Gate about 10,000 B.P. and began flooding the set of river valleys that flowed through the area during the Pleistocene. These river valleys formed what are now the northern and southern arms of the bay, the southern arm draining much of the Coast Range and the northern arm the Sierra Nevada. The progressive shorelines formed during the latter part of the Holocene Transgression in the bay followed the courses of these drainages, gradually backing them up until the present configuration of the bay was reached.

Potential archaeological deposits underneath the waters of the bay are well protected by a mantle of Holocene sediments and bay mud, which reach thicknesses of up to 40 m near the center of the bay, and average around 10 to 15 m in the outer portions. The bay sediments are not subject to the ocean wave action characteristic of the open coastline, and are thus likely to be relatively well preserved.

Several paleo-landforms potentially affecting archaeological sensitivity were present in the area now occupied by the bay, including river channels, bayshores, and islands. As noted above, two major river systems were present in the area prior to about 10,000 B.P., one occupying what is now the northern arm of the bay, and one occupying the southern. These probably provided productive riparian systems during the early part of the Holocene Transgression (18,000 to 10,000 B.P.), and into the later Holocene prior to complete infilling of the bay. Two islands are identified within the bay: Angel Island, formed just prior to 7,500 B.P. when the rising waters separated it from the Tiburon Peninsula, and Treasure Island, formed between 5,000 and 2,500 B.P.

The period between 10,000 and 7,500 B.P. saw the development of a substantial embayment inside the Golden Gate, extending northward past present Tiburon and south about 10 km to Richmond Point. As discussed in Section 2.0, the productivity of the early bay environment was probably reduced by the rapid rate of infilling, which prevented the development of mature marshes; nevertheless, the protected environment of the developing bay, with its contact between saltwater and freshwater regimes, was probably attractive to prehistoric populations. After the infilling of the bay slowed, and the bay began to mature as an estuarine system, the area became highly productive as a resource area, and was intensively used by prehistoric populations; thus the bay margins after about 8,000 to 7,500 B.P. are seen as highly sensitive with regard to prehistoric remains.

3.3.2.3 Northern California

This portion of the study area includes areas of the continental shelf between the mouth of San Francisco Bay and the California-Oregon border. The predictive zone map for this portion of the study area shows a strip paralleling the modern shoreline, varying in width from a maximum of nearly 50 km near San Francisco Bay to a minimum of about 4 km offshore of the King Range. As was the case for central California, the westernmost (18,000 B.P.) shoreline is located roughly at the continental slope; shorelines to the east of the continental slope represent Holocene shorelines at varying points along the continental shelf. The most rapid shoreline retreat seems to have taken place between 18,000 and 10,000 years ago, with narrower areas represented by the 10,000 to 7,500 B.P. movement.

In general, most of the continental shelf in northern California is characterized by non-sensitive landforms mantled by Holocene sediments. These sediments may be up to about 150 m thick, but average about 10 to 50 m. From Point Reyes north to Cape Mendocino, however, the sensitivity of nearly all the post-7500 B.P. shoreline areas, and more than 90 percent of the 10,000 to 7,500 B.P. shoreline areas, is reduced by the lack of Holocene sediments. In some areas, such as a portion of the shelf just south of Point Arena, and between present Fort Bragg and Cape Viscaino, Holocene sediments are lacking over the entire continental shelf.

Several submerged river valley systems are identified off the present shoreline of northern California. As shown on the sensitivity maps, the cells associated with these features (letter code d) tend to expand in width with distance from the present shoreline; this represents not the actual boundaries of the landform, but rather the diminishing confidence with which those boundaries can be determined as one moves into deeper water. They are likely areas for river channels, lakes, estuaries, and bays; these areas were highly productive environments, and may have attracted human populations. Major submerged river valley systems are found offshore of several major terrestrial drainages, including the Russian, Big, Mattole, Eel, Mad, Klamath, and Smith rivers, Redwood Creek, and Tomales Bay.

Several small (less than 3 km in length) islands were present at various times off the coast of northern California during the Holocene. Most are associated with the 10,000 B.P. shoreline, though islands are identified off the 7,500 and 18,000 B.P. shorelines as well. The islands tend to be fairly close to the shorelines with which they are associated, and may have been relatively easy to reach using early watercraft.

Although large embayments appear to have been uncommon along the coast of northern California during the Holocene, several did develop, particularly during the past 10,000 years. After about 10,000 B.P., embayments began to develop at Drake's Bay, in the lee of Point Reyes, and Tomales Bay, about 25 km to the north; both of these areas provided protected and probably highly productive environments. Tomales Bay, formed by the infilling of the San Andreas fault in this area, is a relatively recent phenomenon, developing most of its extent after 7,500 B.P., although an embayment did begin forming there at about 10,000 B.P. Other recent embayments are found at Humboldt and Arcata bays, and at North Bay and Roper's Slough at the mouth of the Eel River. Identifiable embayments at these locations developed well after 7,500 B.P.

Large embayment structures are found associated with the 15,000 and 18,000 B.P. shorelines seaward of the coast between Cape Mendocino and Punta Gorda. The southernmost of these embayments extends to within one km of the present shoreline, near the present mouth of the Mattole River; it may represent an old river channel, although no submarine canyon is identified in that area. Such channels are identifiable seaward of that point, however, but west of the 18,000 B.P. shoreline. A similar situation is found between Punta Gorda and present Shelter Cove, where an embayment is indicated just shoreward of a submarine channel system.

3.3.2.4 Oregon

The predictive zone maps for the Oregon portion of the study area are characterized by numerous small submerged streams, islands, and a single large curving peninsula near its center. Quaternary sediments are present over most of this area. For the most part, the area forms a strip ca. 15 to 25 km wide. The temporal periods in the matrix are evident as long parallel zones across the gradient of the shelf; the width of the zone being roughly proportional to the rate of sea level change during that period. The most widely occurring relatively higher potential areas on the strip are the 15 small submerged river valley systems. All are the drowned lower valleys of existing terrestrial rivers, and each is clearly associated with a single modern river. South to north, these are: the Chetco, Pistol, Rogue, Sixes, Coquille, Coos, Umpqua, Suislaw, Alsea, Yaquinna, Siletz, Salmon, Nestucca, Tillamook, and Nehalem rivers. Also of note are several groups of small rocky islands associated with earlier sea level stands. Most such structures were emergent sometime between ca. 15,000 and 7,500 years ago. Small islands were most common on the southern coast, particularly between the Rouge and the Sixes rivers, but some were present as far north as the vicinity of the Siletz River.

Beyond islands and drowned river valleys, the most prominent feature on the Oregon coast is a large curving peninsula formerly located in the vicinity of the Alsea and Suislaw rivers. Relatively high ground was present out on the limb of the peninsula, and this structure formed a large embayment opening to the south between ca. 18,000 to 15,000 years ago; both the Alsea and Suislaw rivers may once have drained into the bay. Here again is a habitat which would have been attractive for occupation, and which may have favored the preservation of archaeological sites. In an earlier review of a possible early human presence on the continental shelf of Oregon, Bell

(1980:13) identifies this area (he terms it the "Alsea Peninsula") as having a particularly high relative potential for containing submerged prehistoric sites. We agree that this area has a number of positive attributes, but note that isopach data summarized in this study indicate that large portions of the former peninsula, particularly on its western side, lack Quaternary sediments. As such, the potential of this area is perhaps somewhat less than that visualized by Bell (1980). This condition not withstanding, those portions of the Alsea Peninsula, and the mainland side of this bay, which retain Quaternary sediments must still be considered to have a relatively high potential to contain prehistoric archaeological resources.

3.3.2.5 Columbia River Mouth

The predictive zone maps for the Columbia River mouth portion of the study area are marked by a single very large submerged river valley. The structure is clearly the lowermost portion of the Columbia River Valley. Consistent with adjoining areas, this system crosses a strip ca. 20 km wide. The temporal periods in the sensitivity matrix are evident as long parallel zones across the gradient of the shelf.

Within this area are both a large protected-water embayment and the western terminus of a natural river corridor across the Cascade Mountains. The area is likely to have been attractive for early human occupation. Additionally, given the vast quantities of sediments transported by the river, the entire outer continental shelf in this area is mantled with Quaternary deposits capable of protecting prehistoric archaeological resources. No other potentially attractive landforms have been identified in the subarea.

3.3.2.6 Washington

The predictive zone maps for the Washington portion of the study area share many features with those for Oregon: both marked by numerous small submerged river valleys. Quaternary sediments are present over most of this area. The shelf width along the Washington coast varies somewhat. Narrowest on the northern end, it broadens to almost 40 km on the central coast and then tapers again as it nears the Columbia River mouth. The most widely occurring, relatively higher potential areas are nine small submerged river valley systems. All are the drowned lower valleys of existing terrestrial rivers, and each is clearly associated with a single modern river. South to north, these are: the Willapa, Chehalis, Quinault, Queets, Hoh, Goodman, Quileute, Ozette, and Sooes rivers. Somewhat surprisingly, no Holocene islands (other than the currently existing islands) appear to have existed along the Washington coast.

The Washington coast portion of this study area is also marked by two very large embayments, Gray's Harbor and Willapa Bay, which probably did not appear until sometime in the last 10,000 to 7,500 years. They are large protected water bodies which include the lower channels of a number of small coastal river. Similar embayments do not occur closer than San Francisco Bay in California. These areas offered extensive attractive habitats for earlier human occupation. While transported sediment loads were probably much less than in the nearby Columbia River mouth, sediments in sufficient quantities to protect cultural materials appear to have been deposited here.

4.0 SUMMARY

The predictive model from which the predictive zone maps were produced is based on a two-dimensional sensitivity matrix correlating five geomorphic features with five temporal periods (Table III-2). A more complex matrix integrating information from the available archaeological and geological databases was considered inappropriate at this time because of the limited and uneven nature of those databases over the study area. Although the model's assumption of similar site distribution patterns over the entire spatial and temporal range does not hold entirely true, available data demonstrate that certain site types do cluster around readily recognizable landforms.

Isopach and paleo-landform maps of five subareas within the MMS continental shelf study area were overlain and predictive zone boundaries were drawn according to the individual matrix cell definitions. Inundated landforms within each subarea having a relatively high probability matrix designation are discussed with the appropriate maps. An examination of geomorphological processes and the related potential for site preservation demonstrates that significant prehistoric archaeological resources may exist on the OCS. These resources may be associated with previously defined cultural complexes or may represent a previously undefined maritime adaptation not reflected in the current archaeological record.

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